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**Abstract:**

This thesis explores the research question *How can lighting be used to support the gathering ritual in aesthetic performances described by Richard Schechner?*

The exploration is founded on the development of a lighting design for a theater foyer. This design was achieved by combining theory from the academic discipline Performance Studies with Lighting Design and Computer Science.

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The background of the entire page is a dark blue field filled with numerous circles of varying sizes. The circles are in shades of purple, from deep indigo to light lavender, and some are white. They are scattered across the entire surface, creating a dense, abstract pattern.

# **A light based preliminary rite for aesthetic performances**

**Jacob Kriegbaum Caspersen**

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# Introduction

Theater has been part of human cultures for most of our time on this planet. It is present in every known culture and is used in a variety of contexts. (Schechner 1976: 43) Even though it is so widespread and has existed for so long, according to the well renowned Professor Richard Schechner at TISCH School of Arts at New York University, they all share a similar structure. (Schechner 1976: 43) Schechner is the founder of the academic discipline *Performance Studies* where performance in a very broad sense is studied with a basis in anthropology. The term performance includes phenomena such as legal trials, political debates, interactions on the street, social drama but also things we might associate more immediately with performances such as theater. Theater is part of what Schechner calls *aesthetic performances*. As we will explore deeper in this thesis, in order to be an aesthetic performance, a theatrical frame is needed. Part of this frame is created by rituals before and after the performance called *gathering* and *dispersing*.

The speed of the technological evolution is incredible! Never before have so many new inventions seen the light of day, and it is happening in almost every field. These new inventions and refinements of inventions create amazing new possibilities. This also goes for lighting design. The developments in LED technology, in regards to size and quality, are already revolutionizing the possibilities we as designers have with lighting. On top of this new technology for making dynamic and interactive solutions makes it possible for lighting to fulfill new roles and gives us the opportunity to rethink our luminous environments.

Can this be used in connection with performances? The gathering and dispersing rituals are all about transformation. Their main objectives are transforming a person into a specific role as an audience member and back again. Lighting already takes part in this transformation. For example a person will experience a significant transition in lighting just from walking on the street to being inside the lobby to a theater and finally taking his seat in the theater house. That way lighting already contributes to the existing rituals surrounding the transformations in aesthetic performances.



We are very used to lighting being part of transitions in nature. For instance the difference in night and day or the lighting in different seasons. But the new technological possibilities gives us new opportunities to use light's transforming effects to a much higher degree than earlier.

In this thesis I will explore how to support the gathering ritual for an aesthetic performance with lighting. My approach is cross disciplinary and I aim to combine knowledge about performance and rituals with lighting design and computer science.

In the thesis I create a concept that works for many kinds of aesthetic performances. In connection to this, it is important to note, that the main product is the investigation of the gathering ritual in relation to lighting, as well as the ideas behind a system, that can support it. The design pursued in this thesis, should not be understood as the main product, but as an example and a basis for this exploration. This still means that the concept and ideas behind the design is meant to work for a wide variety of aesthetic performances. This is also why there will be no consideration of e.g. different designs for specific plays or genres.

The design example will be based in an imaginary lobby in a contemporary theater and not a classical one. This is to avoid having to consider too many external factors such as historical elements in an attempt to keep the design generic and usable in other spaces. This will make it easier to distinguish what is part of the lighting intervention and what is not. Of course even an empty space can have a meaning and communicates something, but it makes the separation of elements easier.

This leads me on to whether or not things can have an inherent meaning. Is it possible to create something that will affect the way people experience a situation in a generic way? There are two opposing views on this; constructivism and realism. In constructivism things can not have an inherent meaning. In stead, meaning is something constructed in the mind of the beholder. Realism is the opposing idea, where people try to pursue things' real inherent meaning. (Olsen & Pedersen 2009: 144+148) In a realist's view a certain design can have its own build-in meaning and thereby it is possible to make a design that can affect people in the same way, who understand it. Thereby it is not only possible ideally to create a generic design in the sense, that it can be used for a variety of performances, but also a generic experience. From the perspective of constructivism the experience of the design and the meaning of it, is

entirely based on the passed experiences of the person experiencing it. An initial thought could be, that one then just might give up on creating anything for others than himself, because anyone is going to experience it differently. But constructivism basically offers the answer to that as well. People experience and judge based on a constructed system in their minds, but even though experiences differ, being aware of the constructed systems is an advantage for the designer. We share many of these constructed systems culturally, and these systems can be taken advantage of.

In this thesis I take a constructivist viewpoint and know, that it is not possible to affect everyones experience in the same way. The only thing I can do is try to tap into some of the mutual codes used in our society. That is why the design will be founded on very general theories about the rituals in aesthetic performances. Thus the research question sounds like this:

## Research question

*How can lighting be used to support the gathering ritual in aesthetic performances described by Richard Schechner?*

# Analysis

The success of any lighting design relies heavily on the designer's understanding of the space and maybe more importantly the understanding of the potential users of this space and the situation they will find themselves in while using it.

Performances can refer to a large range of phenomena. Usually people would agree that a theater play or a concert is a performance, but it can also be understood in a broader sense e.g. as a wedding, a film showing in a cinema, or even a museum exhibition, where the performance is actually done by the artists and the designers of the exhibition, and is played out in the pace of the museum visitor.

In this chapter I will investigate the structure of performances and the rituals surrounding them. With a base in anthropology and performance studies theory, this is done in order to shed some light on the situation of the potential users of the design. As we will see in this chapter, rituals and performances all follow the same specific structure, and the performers and spectators undergo several transformations. The aim of this thesis is to investigate how to support these transformations with lighting, and after this chapter we will have a foundation of knowledge on which a design proposal can be build.

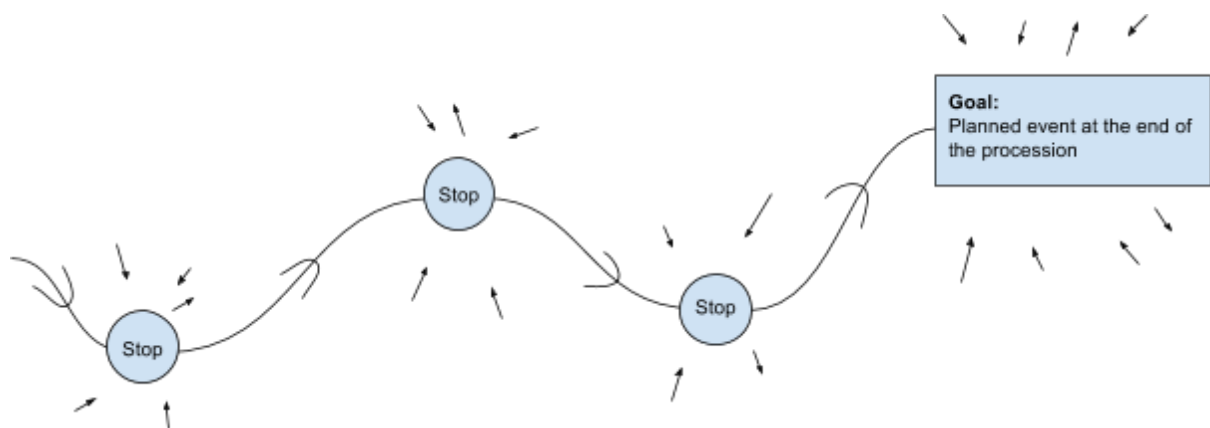
First the reader will be presented to classic anthropological texts by Richard Schechner and William Turner. Afterwards a practical approach especially to the qualitative aspects of architectural lighting design is presented based on literature by Richard Kelly. With this step actual design tools will be presented and later utilized as we move closer to an actual design.

Many different things are investigated in this chapter and very different subjects will be examined. This might seem confusing at first. However in the Design chapter we will see how all of this information was crucial in order to create the basis for the lighting design.

## Processions and Eruptions

Richard Schechner is one of the founders of the academic field Performance Studies (nyu.edu, 9th june 2016). In the heavily referenced *Towards a Poetics of Performance* (1976) he describes the structure of performances from an anthropological view.

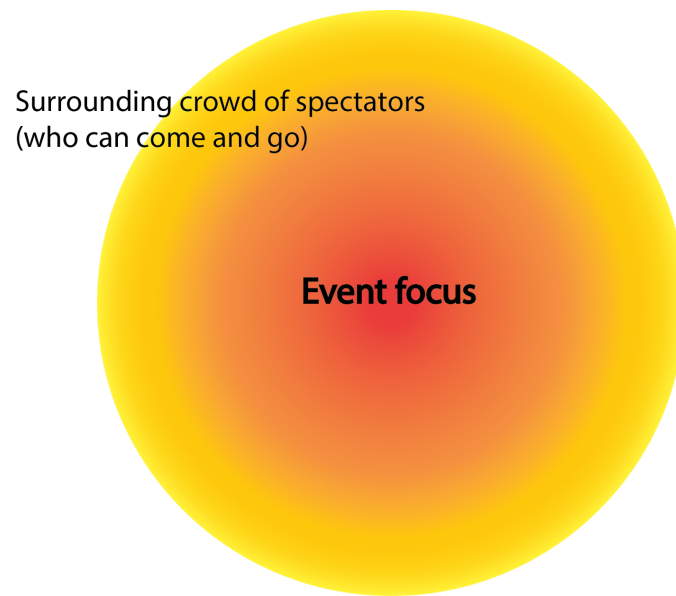
Rituals and performances seem to always have been part of human cultures. By drawing references to the earliest human societies, contemporary tribes in New Guinea and everyday society, Schechner claims, that there are two naturally occurring types of performances: Processions and eruptions. All performances follow one of these principles or a combination of the two. (Schechner 1976: 44-45)



*The procession - based on Schechner's illustration (Schechner 1976: 45)*

Processions are performances that has a predetermined path towards a final goal where an event will take place. During this procession there can be several stops on the path where smaller or bigger performances are played out. An example of the procession is a political march. Here people meet at a certain point and move towards a set goal, fx a town square. Underway spectators have the opportunity to join or leave the march towards the end goal. A procession can also be a funeral procession where the crowd follows the dead body towards the grave. (Schechner 1976: 44)

The other type of performance is called an eruption. It is characterised by having a heated center in the middle where the focus lies and a colder or less intense outer rim, where spectators can come and go. (Schechner 1976: 45) Eruptions can for example be a football match. Here the attention is on the players on the field in the middle. Around the field are the spectators who are watching the game, but might leave for a while to get beverages or food.



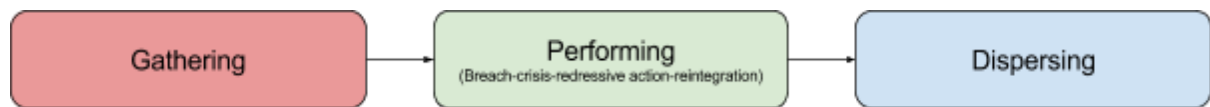
*The eruption - based on Schechner's illustration (Schechner 1976: 44)*

An eruption can also be caused by an accident happening on the street and a crowd gathering to discuss and reconstruct what happened. The end of processions can very often be considered a type of eruption.

## The Structure of Performances

There is a close relation between performances and social drama. According to the anthropologist Victor Turner, social drama can be anything ranging from an argument to an international political crisis. After spending several years in African villages Turner found that there is a universal progression in social dramas. Social dramas all have a *breach*, *crisis*, *redressive action* and *resolution/reintegration*. (Turner 1996: 10-11) Based on Turner's conclusions, Richard Schechner found, that this structure is also always present in aesthetic drama and staged (planned) performances, but with a twist: What separates social drama from aesthetic drama is first of all the initial- and ending phases or the so called *gathering* and *dispensing* rituals. (Schechner 1973: 50)





*The structure of aesthetic performances (Schechner 1973: 50)*

Social drama create lasting transformations for the involved, whereas aesthetic drama create temporary transformations for for the actors and potentially permanent changes for the audience. The gathering and dispersing rituals are there as part of a theatrical frame for the staged drama that is playing out. They work as transformations for the audience from a real to a fictional world and back again. This way spectators will not feel compelled to intervene in the performance. (Schechner 2003: 51) That means that if a person sees someone steal a purse from an old lady on the street, the person might feel compelled to intervene even though it is actually an aesthetic performance on the street. If it is happening inside a theatrical frame it is different. It might sound banal, but establishing this frame is important. (Schechner 2003: 50-51)

*"When people 'go to the theater' they are acknowledging that theater takes place at special times in special places. [...] Not only getting to the theater district, but entering the building itself involves ceremony: Ticket-taking, passing through gates, performing rituals finding a place. [...] Ending the show involves ceremony: applause or some formal way to conclude the performance and wipe away the reality of the show re-establishing in its place the reality of everyday life"* (Schechner 2003: 50)

Often time the gathering and dispersing elements of a performance are neglected, but they are important to prepare the audience for the transformation back and forth. A gathering ritual can consist of different parts but usually it involves a place where the soon-to-be audience can meet, gather and talk to each other. This makes the transition more smooth. It is quite rare in a theater to walk straight into the room where the performance is going to take place. For the proscenium theater Schechner mentions that "The lobby, which extends into the street under the theater marquee is a gathering place for the audience." (Schechner 2003: 47) The dispersing part of a performance is also important to help people digest the experience and

reintegrate into the reality. It is often seen in movie theaters that the exits leads straight to the streets with no possibility of hanging around for a little while. While this might be smart logistically, this makes the transition from movie theater to real life quite rough and unpleasant.

## Rites of Passage and Liminality

Rites of passage in western society are perhaps best known by traditions linked to the church such as baptisms, confirmations, weddings and funerals. These rituals are carried out to mark the transition from one *state* to another that is recognized in the culture that they are a part of.

*“State, in short, is a more inclusive concept than status or office and refers to any type of stable or recurrent condition that is culturally recognized.”* (Turner 1967: 46)

Victor Turner writes in the article *Betwixt and Between: The Liminal Period in Rites de Passage* (1967) about the structure of Rites of passage. Turner refers to the French anthropologist Arnold van Gennep who claimed that rituals and specifically rites of passage have three stages with different characteristics. There is a separation rite, transformation rite and a reintegration rite. During the transformation rite the subject of the ritual enters the so called liminal state. (Turner 1967: 47)

Weddings are good and very clear examples for explaining these states, but other rites of passage might be less explicit about the structure - while still following it. The female in a wedding changes state three times going from being a *Miss*, then a *bride* during the wedding and then finally a *Mrs.* - often with a new surname.

The separation rite in weddings often for the female includes a number of elements to prepare for becoming a bride e.g. changing into a specific gown that is only for wearing on that particular day which further underlines the temporal status of being a bride.

The liminal status of the female subject in a wedding is the bride. In the liminal transformation rite, the subject actually temporarily is without an identity and property. That is also symbolized by wearing a dress that is not to be worn for any other occasions.

*“A further structurally negative characteristic of transitional beings is that they have nothing. They have no status, property, insignia, secular clothing, rank, kinship position, nothing to demarcate them structurally from their fellows”* (Turner 1967: 49)

When the subjects of the wedding rite of passage say “I do” to each other they start reintegrating into the society and are given a new status as husband and wife. Here the reintegration rite includes walking down the aisle, rice throwing, wedding party, speeches etc. So in rites of passage the separation rite seeks to strip the subject from identity - in the transformation rite, the subject have nothing - and in the reintegration rite gets a new identity. According to Jørgen Østergaard Andersen (1993) the liminal stage (the transformation rite) is the exact opposite of the normal structured everyday life. (Andersen 1993: 15)

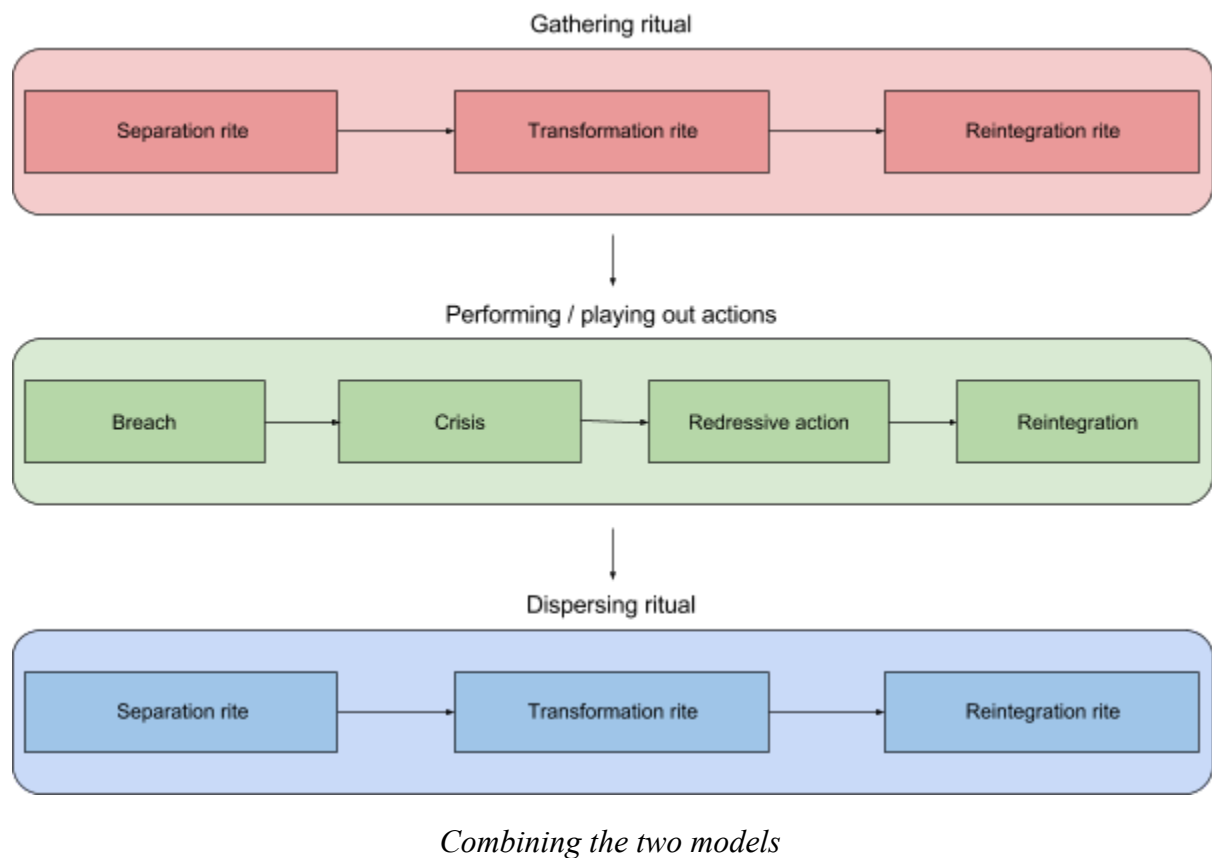
## Gathering the Pieces of the Puzzle

According to Richard Schechner rites of passage and liminality are actually present in all kinds of performances and not just e.g. wedding rituals. As mentioned above, performers and audiences can be transformed temporarily or permanently during a performance. Turner calls aesthetic performances liminoid because they look like the liminal rites and have the structure of social drama. (Schechner 2003: 52)

There are similarities between the structure of performances of gathering - performing - dispersing mentioned earlier and the separation - transformation - reintegration structure. What goes on during a gathering ritual in an aesthetic performance is a preparation of the audience that makes them ready for the transformation that Schechner mentions happens during the actual performance part. Similarly the separation rite is a preparation of the subject who is going to go through a rite of passage and be transformed during the transformation rite.

The specific structure of an individual gathering or dispersing ritual shares the structure of the rites of passage and thus become a mini rite of passage. As Schechner writes there are also liminoid rituals connected to gathering and dispersing and in e.g. a theater, the status of a person changes into becoming a member of the audience where certain rules apply, that are often very different from whatever role that person came with. (Schechner 2003: 50) So in

fact the gathering and dispersing rituals can be understood as mini rites of passage because of their status-changing properties for the subjects involved. Thus the overall model for a performance will look like this:



The above model is a combination of Schechner's model for performances and Turner's model for rites of passage and social drama. Theater foyers are used for the liminoid gathering and dispersing rituals. In the design chapter, using this for an actual lighting design will be explored.

## The Ideal Audience

In this thesis and for the lighting design the focus will specifically be on the gathering ritual that is part of creating the theatrical frame for an aesthetic performance. As mentioned above, it is during this ritual that the subject coming from outside is getting a new status - a member of the audience - and is prepared to be transformed during the actual performance.

Most importantly of all, the ritual should work as a mark and underline, that there is a difference between inside and outside of the performance - that here there is a change, that the same rules does not apply and a new status will be obtained. On top of that it should be specified what kind of audience the gathering rite should transform people into. In this paragraph I will discuss what can be regarded as an ideal audience, and thus what properties of an audience the design should pursue to help create.

There might not be such a thing as an objectively ideal audience. First of all one might ask in whose opinion the audience is ideal. An ideal audience might be very different for example for the director of a theater play, the actors, the architect of the theater or the individual audience members themselves.

Secondly the ideal audience and thus the ideal gathering ritual might be different from one theater play to another. The question is then if there are any common denominators or preferences about an audience that are fundamental to all aesthetic performances.

I argue that most people involved in a theater play, whether they are performers, directors, set designers or audience, would be interested in having the best possible conditions for the exchange of sensorial information between what goes on on the stage and the audience. If this idea is accepted an ideal audience would be an audience that are *ready* to experience the theater play. Being ready requires the senses of the audience to be prepared to receive information. This is especially true regarding the visual sense since it is responsible for 70% of our sensorial information (Marieb & Hoehn 2007: 556), and especially in a theater situation, where the things going on on stage are mostly picked up by sight and hearing. With that said, the other senses, taste, smell and touch should not be ignored. Things mostly experienced with one sense might affect other senses. So when a person sees a tree in the woods he might have an idea of how the bark feels or if he sees a lassagne he might almost be able to taste or smell it. So this information is received visually but creates connotations, and thus the ritual should try to wake the senses of the people - especially the visual sense - by stimulating them in order to make them aware of them.



# Fundamental Aspects of Architectural Lighting Design

To create the best possible lighting design it is important to be aware of all possibilities and parameters of creating with light, in order to have a rigid foundation. In this paragraph I will present the fundamental building blocks that a lighting designer can use in order to achieve his or her goal.

Richard Kelly is by many regarded as the founder of the actual discipline of architectural lighting design. He opened his practice in New York as early as in 1935. He had a background in theatrical lighting and graduated as an architect. He identified three main forms of lightplay that created the basis of his approach to lighting design. These are *focal glow*, *ambient luminescence* and *play of brilliants*. This approach is widely used today and is very often included in contemporary literature about lighting design. (Livingston 2014: 10-11)

These three concepts are probably best explained through Kelly's own poetic words:

*“Ambient luminescence is a snowy morning in open country. It is twilight haze on a mountaintop, or a cloudy day on the ocean. It is underwater in the sunshine, or inside a white tent at high noon. (...) Ambient luminescence minimizes the importance of all things and all people. It fills people with a sense of freedom, of space and can suggest infinity.”* (Livingston 2014: 11-12)

The ambient luminescence is mainly the quantitative aspect of lighting. It refers to the general lighting of a space. The importance lies in designing lighting that gives enough light for the visual tasks that are to be carried out. (Ganstaht & Hoffmann 1992: 24)

*“Focal glow is the campfire of all time, the glowing embers around which stories are told (...) the sunburst through the clouds, and the shaft of sunshine that warms the far end of the valley. (...) Focal glow is the pool of light at your favourite reading chair. (...) Focal glow commands attention and attracts interest. It fixes the gaze, concentrates the mind, and tells*

*people what to look at. Focal glow separates the important from the unimportant.”*  
(Livingston 2014: 11)

The focal glow can be seen as a way of structuring the visual environment, putting emphasis on specific elements in the space. It is used to attract attention and focus more on the qualitative aspects of lighting as opposed to the ambient luminescence. Not only does it enable a viewer to perceive information about an object. It provides information in it self, by establishing what is important. (Ganstalt & Hoffmann 1992: 24)

*“Play of brilliants is the aurora borealis, (...) the Versailles Hall of Mirrors with its thousands of candle flames. Play of brilliants is Times Square at night, (...) the magic of the Christmas tree, Fourth of July skyrockets. (...) Play of brilliants excites the optic nerve, in turn stimulates the body and spirit and charms the senses. It creates a feeling of aliveness, alerts the mind and awakens curiosity, and sharpens the wit. Play of brilliants quickens the appetite and heightens all sensation. It can be distracting or entertaining.”* (Livingston 2014: 12-13)

The play of brilliants is the most quantitative of Richard Kelly’s concepts, where the lighting is not necessarily providing information about objects in the space, but where the lighting in itself is a medium of information. Play of brilliants are meant to excite and stimulate the senses of the users of the space. (Ganstalt & Hoffmann 1992: 24)



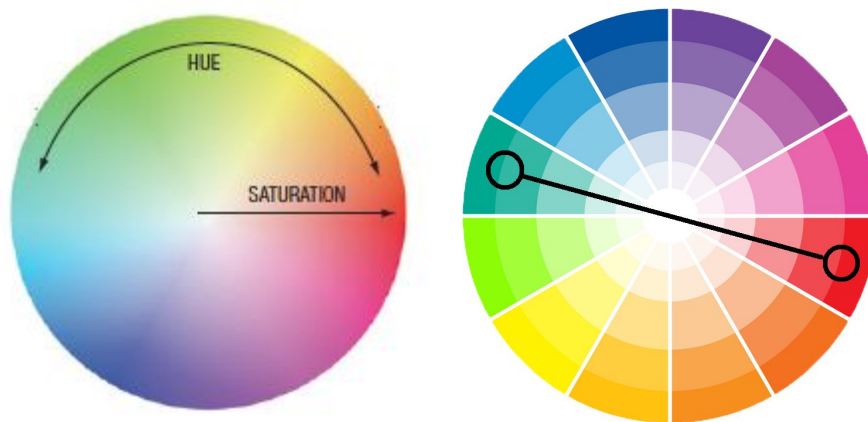
*Ambient illumination, focal glow and play of brilliants*  
(<http://www.lorlighting.com/uploadfile/20121029173605358.jpg>)

These three concepts constitute tools for lighting designers. They have to work together, and all of them should be considered for a successful lighting design.

## Colour Theory and the Effects of Colour

According to Jason Livingston in *Designing with Light* (2014) for most of the history of lighting design, colour besides colour temperature of white light was almost never used in architectural lighting because it was considered inappropriate. However, this has changed and colour is now used in many projects. (Livingston 2014: 109)

Light obeys to an additive colour system meaning that if an equal quantity of all different colours are mixed together they will create white. This can be illustrated on the colour wheels below where the middle is white.



*(Right) Colour wheel showing relationship between hue and saturation. (Left) Colour wheel showing how complementary colours are placed (Descottes 2011: 44)*

Navigating in colours can be done in different ways but in lighting the most important are HSB (hue, saturation, brightness) and RGB (Red, Green, Blue). HSB (sometimes referred to as hue, value, chroma) works with the hue corresponding to where along the edge of the colour wheel the colour is located. The saturation determines how far away from the center the colour is. RGB is a bit different. Here the colour is found by knowing how much of the

primary colours make up the colour. This is often really useful when working with lighting, since many LED luminaires have individual Red, Green and Blue diodes.

The HSB system makes it easier to work with such concepts as complementary and monochromatic. A colour's complementary colour is located exactly opposite to that colour on the colour wheel. To find a complementary colour when working with HSB you just need to add half of the circumference of the colour wheel to the hue value. This is much more complicated using RGB as we will see in the design chapter, because of the minimal relation to the colour wheel.

Complementary colours can be used to make specific elements stand out. This is simply because it is the exact opposite colour to the other. A monochromatic colour scheme means using the same hue for everything. This makes the specific elements in a scene stand out less, and become part of the same.

# Design

In this chapter I will gather the knowledge from the previous chapter and incorporate it into a lighting design. As mentioned in the introduction with this thesis I aim to illustrate how this knowledge about performances and the rituals surrounding theater can be translated and used in a lighting design. This will be explored through a perspective of architectural lighting design and computer science. The chapter will end in a description of a final idea where elements of this will be tested and reflected upon in the following chapters.

## Setting the Stage for a Gathering Ritual

In the analysis it was described how theater foyers are made for gathering and dispersing of audiences. However for simplicity the main focus of the design is on the gathering ritual even though it might not require much more to support the dispersing as well. The lighting should be inviting for the activities in the gathering ritual and support the transformation that the subjects go through, entering the role of audience members, by using the structure of the rite of passage. This will be the foundation on which the lighting design will be build. With this foundation the main objectives of the lighting design described in this chapter should be the following:

### **Objectives for the lighting design that supports the gathering ritual**

- Have the chronological structure of a rite of passage
- Attract people and invite them to socialize
- Underlining that there is a shift from what happened before entering the foyer and what is happening after.
- Warm up the visual sense of the people and prepare and excite them before the beginning of the performance

As mentioned earlier Richard Schechner believes, that there are two types of naturally occurring performances - eruptions and processions. Both approaches could be considered for



supporting the gathering ritual and the transformation between two roles. Initially an idea was to make a procession where the audience members would walk through a hallway. Based on where in the hallway the people where the lighting would appear differently. This could for example be done electronically with sensors and individually controlled lights or with optical illusions using prisms or mirrors. This would first of all symbolize how their perception of their surrounding world would change while physically and mentally going from one stage to another. Other types of processions have also been considered. However using the procession structure would mainly focus on the transformation part and might neglect some of the other aspects of the gathering ritual. According to the Oxford Dictionary gathering used as a noun means *“An assembly or meeting, especially one held for a specific purpose”*

(Oxforddictionaries.com, June 9th 2016).

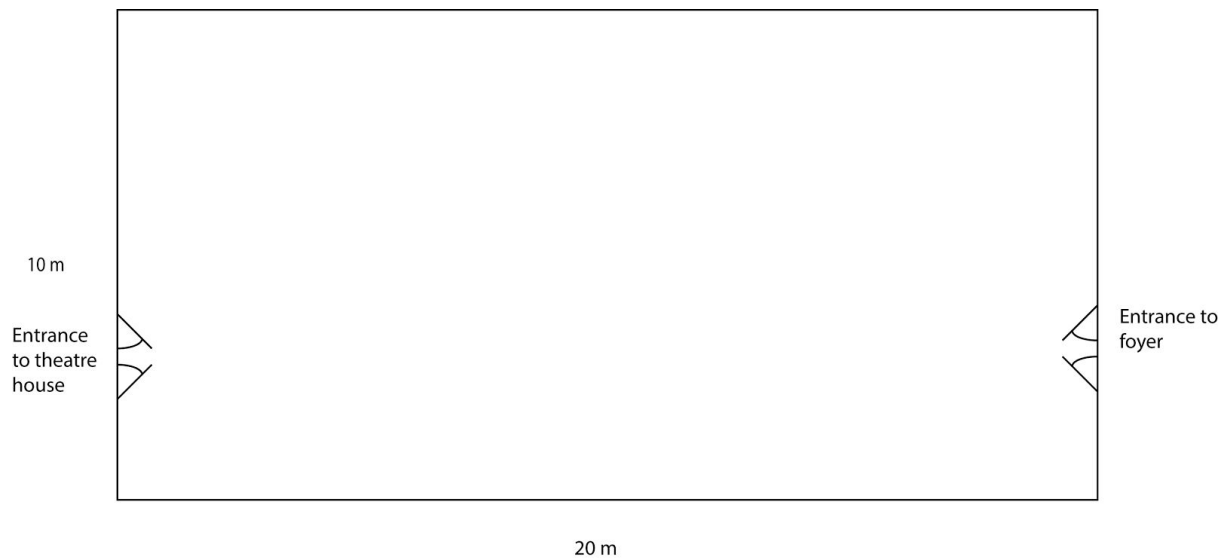
Furthermore Schechner mentions the importance of the social aspect during the gathering ritual. (Schechner 1976: 43 + 50) In order to incorporate the social part it might make more sense to use the more geographically static structure, eruptions, for the gathering ritual. The foyer in theater has been used for many years for this exactly, so using new methods and technology in lighting to support this ritual with an eruption or eruptions inside the foyer seems like the best approach.

## The Basis - a Generic Approach

As mentioned in the introduction the proposed lighting design will mainly be aimed for a contemporary theater and not a classical one. The reason for this is to keep it as focused and simple as possible. Using a historical space as opposed to a new and empty room with no history to consider might complicate the design proposal and thereby the focus of the thesis. With that said, there is of course always a meaning to a space even if it is empty, just as there is information in an empty canvas. But still it is easier to distinguish what is part of the lighting intervention from what is already there by using the empty room.

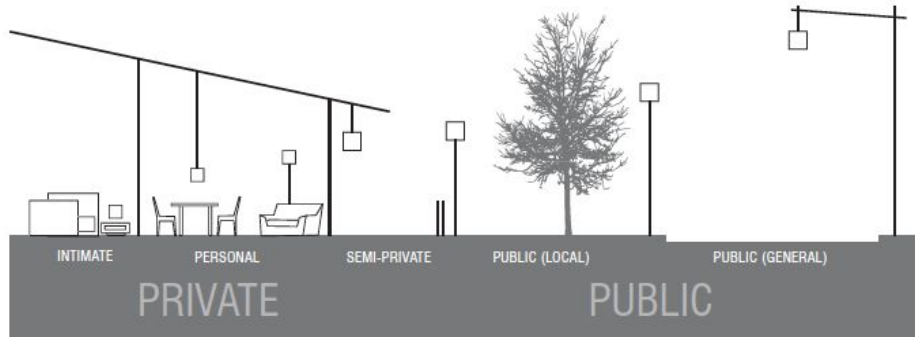
Theater foyers also come in quite a wide variety of proportions ranging from small sized rooms to big halls and even outdoor spaces. To illustrate how the theory from the analysis can be used in different lighting design contexts I will minimize the complexity of the space used

in the concept. This lighting design proposal will therefore be placed in a small rectangular room - 20m x 10m x 3m. The space would look like this:



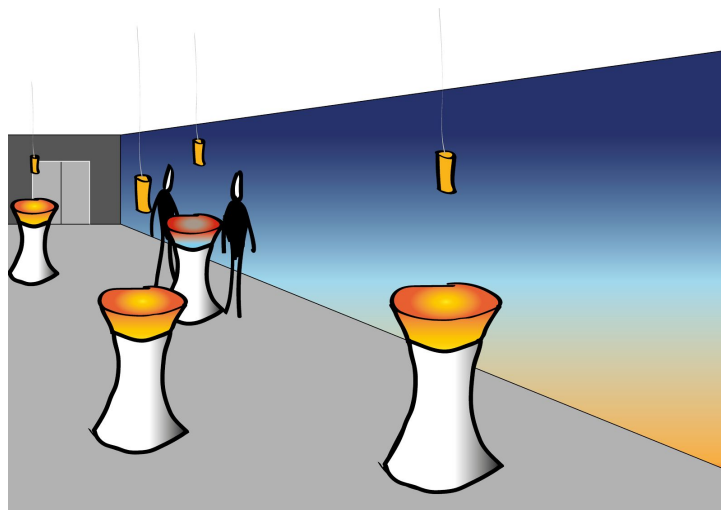
## Towards a Design

So for supporting the social part of the gathering ritual this foyer needs need a design that invites people to gather. Using bar tables as points of focal glow, that invites for social interaction, seems like a good approach. People have probably since the discovery of fire gathered around campfires for social interaction. They have interesting qualities as they are warm and somewhat repetitive while still continuously forming unique flames. I argue that seeing a campfire or something similar invites people to gather around it. The sheer connotations to a campfire makes people feel welcome. This statement will be reflected upon later with the use of focus groups. At the same time, according to Hervé Descottes, being close to the light source is closely related to the feeling of intimacy. Also the height of the light source is related to the element of intimacy. The lower the light source is placed the more intimate the situation becomes (Descottes 2011: 54-55). Invoking a feeling of intimacy makes sense in an attempt to further support the aspect of social interaction.



*The lower the light source is placed, the more intimate the situation becomes*  
(Descottes 2011: 55)

As discussed earlier the experience of being in the foyer should have characteristics of an eruption. With the use of the tables they can act as centers for small individual eruptions. The gathering ritual's specific structure is related to time. Modern technology gives us tools and creates more freedom for designers and enables us to make automated systems that adjust to external parameters such as time. This makes it possible to create a light sequence inspired by the structure of gathering ritual. A way of doing this could be using changing color combinations. As mentioned in the analysis, colour combinations can be used to include or separate. Sequences can be achieved by combining the color of the tables with the colours of the surroundings. A first draft of this idea looks like this:



*Early sketch of concept*

In this concept the tables work as campfires that invite people to gather around them and interact. On the walls of the foyer is an LED video matrix. These walls have a specific sequence of colours and amount of brilliants. Richard Kelly's description of play of brilliants can be interpreted in different ways, but in this case by brilliants, I mean an effect similar the sparkles of the reflection of the sun on water or the many flashes of cameras among audiences at sport events and concerts.

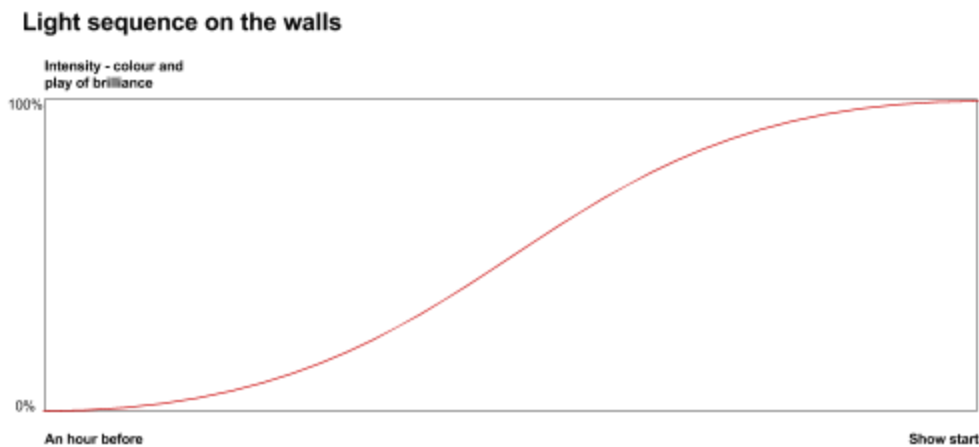


*Reflections in water and flashes among an audience (Picture 1 and 2)*

The walls should then both provide an ambience luminescence of colours in the space as well as play of brilliants inspired by water, while the tables will create focal glow inspired by campfires.

## Sequences of Light

As described in the analysis, Richard Kelly writes how play of brilliants (...) *excites the optic nerve, in turn stimulates the body and spirit and charms the senses. (...) Play of brilliants quickens the appetite and heightens all sensation.*" (Livingston 2014: 12-13) The idea is to take advantage of this and intensify the play of brilliants and the visual stimuli before the beginning of the performance. The reason is to prepare or warm up the audience's senses, and excite them. At the same time it would also be a good indicator of how long it would be until the play would start.



Instead of using a linear progression of the amount of activity in the play of brilliants and the intensity of the colours, a sine wave is used. This choice is based on an expectation, that this will increase the tension further towards the beginning. The idea can be explained with an analogy. If you imagine accelerating in a car (without worrying about gears) the acceleration and the sound of the engine follows the same type of curve. First the car accelerates slowly and picks up speed and eventually when the engine is going its fastest, it is almost struggling to go faster. This is the most intense part where even though the speed is high the acceleration is actually low. In contrast, using a linear line, there would be no variation in the acceleration, and the sequence might feel dull and mechanic rather than exciting and organic.

**The tables** in the concept have a double role. As explained, on one hand they work as campfires that invites for social interaction. They share the characteristics of an eruption with a heated center and a cooler, and cooler outer rim. (see *The Structure of Performances*). On the other hand they can be used to support the soon-to-be audience's rite of passage. What follows here is an artistic interpretation of the rite of passage structure.

When people stand next to the tables, they will be coloured by the light from them. At the same time, another sequence can be created by the combination of the colours in the tables and from the walls. That could work by having a dynamic sequence of the colours in relation to the walls in all of the tables at once. However, as people arrive to the space at different times, not everyone would get through the entire sequence.



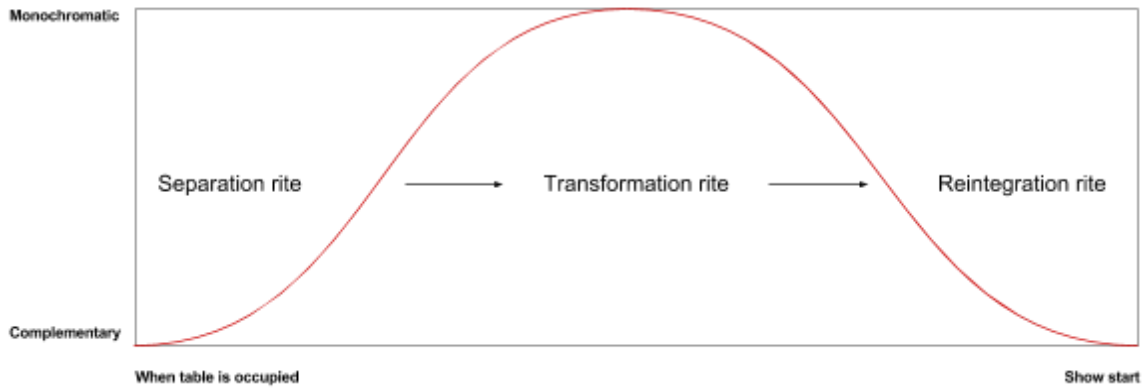
How it should work is, that the system should be able to sense if anyone was standing by the tables. When that would happen, after a few seconds, an individual light sequence for that table would fade on. The light would illuminate the person and the colour of it would start as a complimentary colour to the present colour on the wall. The length of the sequence would be relative to the amount of time left between the activation of the table and the start of the show. In the middle of the sequence, the colour of the table (and person) would have faded into the same colour as the wall and by the end it would turn back to a complimentary colour. The sequence would go from complimentary to monochromatic and back to complimentary before the show start. The sequence would only be able to activate if more than five minutes were left in order to avoid a too fast and distracting change.

The reason for this progression is to mimic the progression of a rite of passage. The first part would be the separation rite, where the colours would be complementary to each other clearly separating the individual from the surroundings and thus symbolising an identity and a status. Slowly the combination of the lights would become closer to each other and symbolising the fading out of the person's previous identity and status. In the analysis we learned that in the liminal part or the transformation rite, the subject loses everything that identify them with their previous status. Again quoting Turner:

*"A further structurally negative characteristic of transitional beings is that they have nothing. They have no status, property, insignia, secular clothing, rank, kinship position, nothing to demarcate them structurally from their fellows"* (Turner 1967: 49)

This is symbolised with the middle of the sequence being monochromatic and thereby making the perception of the colour of their clothes and body almost completely dependant on that one colour from the light at the same time as blending the people in with the surroundings. After the transformation rite the colour of the person (and the table) gets separated from the surroundings again and a new status is being build up. Thus the sequence for the colour of the tables in relation to the wall would look like this:

### Colour of tables in relation to wall



That way by using light the appearance of every person goes through a sequence marking the transition between non-audience member to audience member.

Besides the wall and the tables, a pendant would be hung over each table. This pendant would not change colour and would just provide a small amount of vertical illumination of the faces in order to fill out shadows on the faces from the tables and making people more pleasant looking and their facial expressions more readable, keeping in mind that this is a social situation.

### The Design of the Tables

The tables should mimic a campfire while still being usable as tables. Barrels with fire in them and the fireplaces scattered around Tivoli at Christmas was an inspiration for this.



*Firepit in Tivoli, Copenhagen & fire in barrels (picture 3 & 4)*

In order to contain a fire, the surrounding material has to be quite robust and durable. Even though the light source in the tables would be LED and not necessarily very warm, to give the illusion of a fire, a robust material was required.

Both the barrels and the firepits are made of metal. However metal conducts heat very well. Using another material that would not conduct heat as efficiently, such as concrete or stone might make the tables more approachable in the sense that people would not expect the surface to be hot. Also feeling cold metal on the tables might give away part of the illusion of an actual fire. After prototyping many different materials using 3d renderings I ended up with a concrete mixed with lots of stone. This material is quite dark and makes the tables look robust and heavy.

For the top of the table a slightly diffused glass was used to scatter the light, hide the light source and emit the light towards people from a large surface rather than a concentrated one. This makes the shadows created by the table softer, and people faces more pleasant looking. It also adds to the fire illusion since campfires emit light from a large surface as well.



*Iteration 2 and 3 of the tables*

For the shape of the tables, it should also look like it could contain a fire. At the same time I wanted a subtle reference to time. Therefore the design was heading towards the shape of an hourglass.

The second iteration (the first being shown on the draft in the “Towards a Design section”) referenced a lot to a barrel. However after reflecting on it with the help of friends and family,

I decided that the design looked a bit too big and heavy. I found that the heaviness of the material could bare a lighter and sleeker design without making it look like it could easily tilt over. A sleeker design would make it possible for people to lean their bodies closer to the tables, and make it look more elegant. Just as the light sequences the silhouette of the third iteration has a reference to a sine wave.

## Designing a Controller System for the Lighting

For the lighting design to work as desired, custom made software was necessary. This part of the thesis explains how I created a piece of software using in the programming language *Processing* that could actually be used and implemented to control the lighting on the walls and in the tables the desired way. I will not go through every detail in the program, but in the appendix the reader will find the full code thoroughly commented. Even if you are not an experienced programmer I encourage you to take a look.

Starting with the sequence on the wall there are two main visible parameters; the colour and the amount of brilliants. As described earlier these both have the progression of a sine wave related to how much time is left before the start of the performance.

In the presented version of the software the colours of the wall run through a spectrum. The colour space was changed from RGB (Red, Green, Blue) to HSB (Hue, Saturation, Brightness) with values ranging from 0-100 instead of 0-255. This makes it much easier going through a spectrum, because only the Hue variable needs to be controlled. As we will see later in this paragraph it also makes it much easier to work with complimentary colours.

```
//Here the wallHue value is calculated. It is sinus to "time passed since the program started"/"Overall amount of time"*90
//wallHue stores a value from 0-100
wallHue=int(sin(radians(timeElapsed/totalTime*90))*100); //int() is used to convert from float. Radians function is used to convert from degrees to radians

//These for-loops generates the dots on the wall
for (int i = 0; i<1500/20; i=i+1 ) {
  for (int j = 0; j<1000/20; j=j+1) {
    //Here the brilliance value is calculated. It is sinus to "time since the program started"/"Overall amount of time"*90
    //Brilliance stores a value from 0-1
    brilliance=sin(radians(timeElapsed/totalTime*90)); //radians function is used to convert from degrees to radians

    // This generates random numbers between 0 and 1000*brilliance. It goes from generating up to 1000 different numbers to only 1 number
    float k = random(1000-(1000*brilliance));

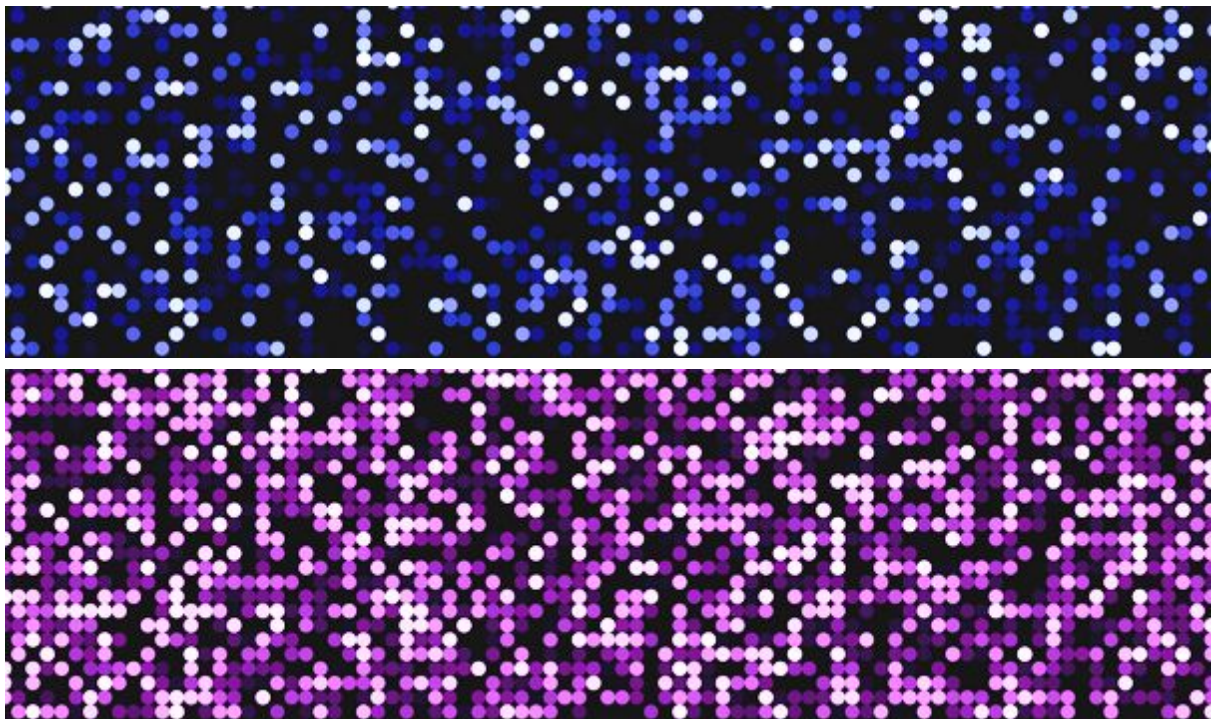
    //In this statement, whenever k is less than 1, a dot appears on the wall. This gets more and more frequent due to the above random generator
    if (k<1) {
      fill(wallHue, 50, 100);
      ellipse(i*20, j*20, 20, 20);
    }
  }
}
```



*The above picture is from the part of the program that calculates colour and amount of brilliants of the wall.*

Sin(0 degrees) is 0 and sin(90 degrees) is 1. In order for the hue value of the wall to progress like a sine wave I took sinus of “time passed since the program started” and divided it by “how much time the entire sequence should take” and then multiplied with 90 degrees. This gives a decimal number between 0-1. After multiplying that with 100, this value can be used as the hue component of the colour of the wall.

The brilliance component was calculated in a very similar way (see picture above) and gives values ranging from 0-1. I used that in a function that generates random numbers. The function work in a way that decreases the range possible of numbers the closer the brilliance component get to 1. Whenever the random number turns out to be below 1 a new dot appears on the wall.



*The pictures above are taken at different times from the running program and is the output for the wall*

An interesting and maybe counterintuitive aspect that was discovered during the process of writing the program was, that the impression of activity did not directly correspond to the speed of adding new dots. Actually when a certain speed was reached the image appeared more static than in the beginning. The solution to this was to implement a function that would make “old” dots disappear faster and faster.

For the light inside the tables, the program was designed to communicate with the light fixtures with the very widely used DMX protocol, enabling a wide variety of luminaires to be used with the program. Most DMX controlled fixtures have settings that a channel for Red, Green and Blue. This makes a lot of sense because these often correspond directly to the individual LEDs inside the fixture. However, only having these three channels can make fading evenly between colours in a spectrum complex. This problem was solved in a clever way. All the colours in the program, including relations between the tables and the walls, are calculated in the HSB colour space where H (hue) corresponds to degrees (actually a percentage of 360 degrees) on the colour wheel. Only when sending the DMX signal to the light fixture, the red-, green- and blue component are sampled from the colour and sent on individual channels to the fixture.

```
//Keeps track of the relationship between how much time has passed since activation of table and how much was left when it was activated
//It store a fraction between 0.5-1.5
monochrome=(timeFromStart/timeLeft)+0.5; //The +0.5 is to make them monochromatic in the middle of the sequence and not in the end

//table is here in HSB100 colour space
//The color is progressing along a sine wave because it is dependant on the wall hue
tableColor=color((wallHue+monochrome*100)%100, 50, 100); //Time elapsed is used as the Hue of the wall. It gets monochromatic then the monochrome variable is 1

//These are sending midi controller signals to fader 1,2 and 3 that control red, green and blue on the fixture
//The colour is a warm almost amber white
//I am dividing by 2 since the faders go from 0-127 and not 0-255
midiOut.sendController(new Controller(1, int(red(tableColor)*2.55/2)-1));
midiOut.sendController(new Controller(2, int(green(tableColor)*2.55/2)-1));
midiOut.sendController(new Controller(3, int(blue(tableColor)*2.55/2)-1));
}
```

*The above picture is from the part of the program that calculates the colours of the tables based on the hue of the walls and at that time the table was activated. In the three last lines it sends the values for the individual channels to the DMX interface*

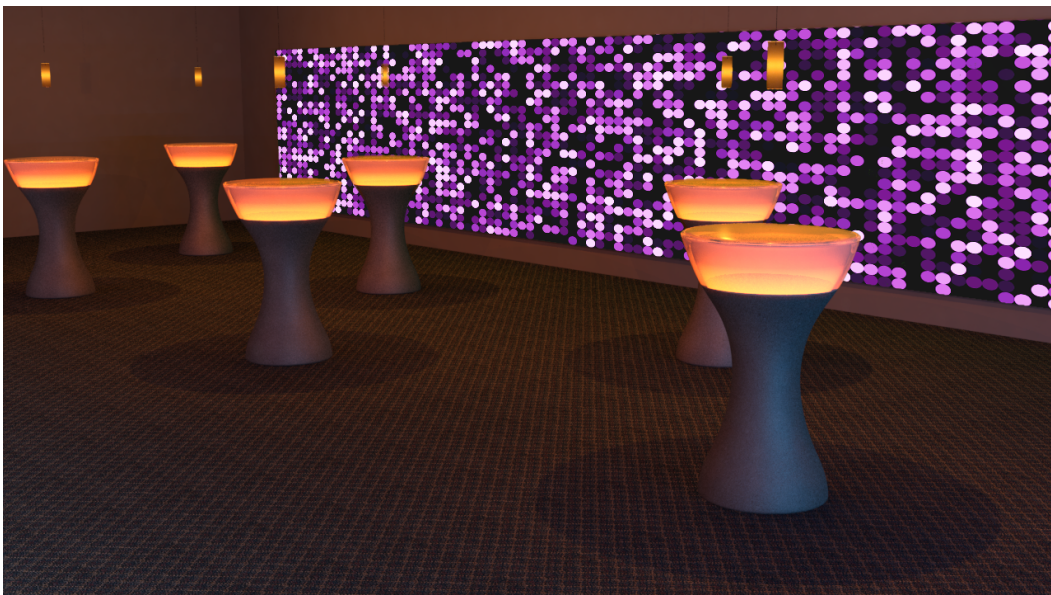
The colour of the tables themselves are calculated by using the hue of the wall and adding a variable I call monochrome. This variable stores a value between 0.5 and 1.5. When 0.5 or 1.5 (50 or 150) is added to the hue value of the wall it results in the colour opposite on the colour

wheel (the complementary colour). When 1 (100) is added it results in the same colour as the wall.

Calculating this variable is done by simply using the amount of seconds that has passed since the table was activated and dividing by how much time was left when it was first activated. 0.5 is added to that to make the sequence start as complimentary colours. The resulting colour of the table still ends out progressing along a sine wave because it is multiplied by the wall's hue value.

## First Complete Iteration - Basis for the Test

To sum up this chapter the concept that will be tested for the theater foyer will consist of interactive tables, an interactive wall and pendants.



### The wall

The wall have a specific light sequence that starts an hour before the beginning of the performance.

- The light sequence of the wall go through a spectrum of hues during this hour.
- The speed of new dots appearing on the wall increases along a sine wave towards the beginning of the performance.





## The tables

Each table have a light sequence that fades on 15 seconds after a person occupies the table.

- When not active, the tables have a warm flame-like colour to mimic a fire.



- The colour of the tables is related to the colour of the wall and the time they were activated. They go through a sequence similar to the diagram above based on when they are activated.





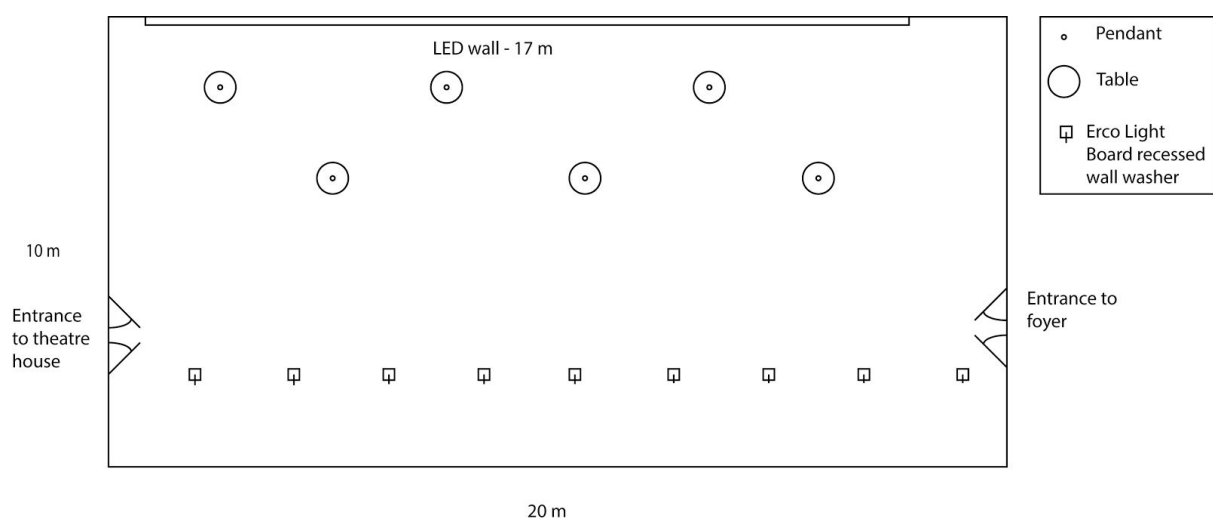
## The pendants

There is a pendant over each table providing subtle static warm white vertical illumination of people's faces

- This is to support the social interaction by making people's faces more pleasant looking and their facial expressions more readable.

## The rest of the space

The wall opposite to the LED wall is lit by 9 ERCO Light Board recessed wall washers. They can provide 3300 lm but are dimmed to 30%.



## *Planview of the design*

### **Summery**

To conclude, the walls will be a quite digital and maybe futuristic interpretation of water. They will provide an increasing amount of excitement by increasing the amount of brilliants. They also have a specific main colour with adjacent colours that goes through a spectrum towards the start of the performance. At the same time the tables, inspired by fireplaces, invite people to interact with each other. They also have a sequence of their own activated when people occupy the table. Related to the wall the sequences for the individual tables create a ritual for the soon-to-be audience transforming them to members of the audience.

# Testing

Lighting design is often an iterative process. This way of working enables the designer to improve his or her design by building something and evaluating it. Using a method of evaluation to learn from what, he has created he or she can now use this new knowledge to improve the design.

For the solution described in the Design chapter, there have been different levels of iterative processes, ranging from visual prototyping by sketching and modelling to the iterative process of programming the controller system. So far individual elements of the concept have been evaluated, but it holds a lot of value to evaluate the concept together as a whole thing.

## Qualitative or Quantitative Testing

On an overall level, an evaluation can be qualitative or quantitative. The quantitative approach enables the designer to make statistical analysis and make general conclusions with known confidence levels. This is a really powerful tool, and in this case they could fx. be used to find out about expectations to lighting in theater foyers or to present different design options to a large group of people, who could select the preferred design. However for this stage of the design a qualitative approach was selected. Besides all its good qualities the quantitative approach also have its limitations. Most importantly it is not possible to have a dialogue with the respondents. This hinders elaborations of specific elements.

Using the qualitative approach makes it impossible to make conclusions on the opinion of the general population of users. However this approach is very good for getting feedback, and spawning ideas for things to investigate further. It is a chance for the designer to evaluate and reflect upon the concept as a whole as well as on individual aspects. One of its biggest perks is the dialogue. In contrast to a quantitative approach it also gives the chance for the respondents to actually experience a prototype of the product in real life rather than a description or a picture of it.

## Discussion of Approaches for Qualitative Testing

In *Design research through practice - From the Lab, Field and Showroom* (2011) Ilpo Koskinen et al argues that in *constructive design research* there are three main ways of evaluating a design; the lab, field and showroom. For now I will not go too much into the showroom approach, but in the following I will discuss whether evaluating the design in the lab or field is more ideal at this stage of the design process.

*“Studying things in a laboratory means that something is taken out from its natural environment and brought into a controlled area where it can be subjected to experimentation.”* (Koskinen et al, 2011: 55)

Using the laboratory approach simply means setting up an experiment in a controlled environment as opposed to e.g. setting up the experiment in its natural environment (the field), which in this case would be a theater lobby. While setting up a field test would most likely also be valuable, there are many benefits of setting it up in an artificial environment. First of all it is complex logistically to set up a prototype system in a theater lobby. Getting permission is another story and a not thoroughly tested system might or might not affect the theater experience in a negative way for the theater goers. A positive element could be, that the people testing it would not have to imagine themselves being in the situation, as it would be the case with the laboratory approach. On the other hand their views might be affected in the sense, that they would expect something more final than a prototype, and might judge it based on that. This is different in the lab where the invited test people already know that it is an imaginary situation, and being in this situation it might feel easier to imagine what the final design would be like and understand that it is a prototype. (Koskinen et al, 2011: 55)

*“The trouble with studying a phenomenon in the real world is that usually many things shape it. This makes it difficult to find what causes something one sees; there are typically several possible explanations, and it is impossible to rule any of them out with a high degree of certainty. Research becomes an exercise in ‘what about if...’”* (Koskinen et al, 2011: 55)

The lab approach also enables the designer to better control the test in order to get feedback on specific elements. In the case of this project, it is a design, that is supposed to work in many of a specific kind of theaters. Theaters can have their differences between them, and choosing one might affect the test. In the laboratory inherent elements such as other lighting and distracting elements can be controlled and kept constant. However it should still be underlined that any space, including the lab, have an perceived effect whether extra elements are present or absent. But in a controlled environment they are easier to be aware of. According to Koskinen et al, the lab also makes it possible to test competing hypotheses which is much more difficult in a natural setting. This is because it would often require interference from the designer. (Koskinen et al, 2011: 55)

Another way of looking at the differences between the lab and the field is the Pries-Heje et al's frame model. Here they describe how evaluation of design can be done *Ex Ante* or *Ex Post* and at the same time be either naturalistic or artificial.

	Ex Ante	Ex Post
Naturalistisk	Designproces / designprodukt	Designproces / designprodukt
Kunstig	Designproces / designprodukt	Designproces / designprodukt

(Pries-Heje et al, 2008: 6)

The division between naturalistic and artificial is roughly the same as the difference between Koskinen et al's lab and field. Ex Ante and Ex Post simply refers to if the evaluation of the design is before or after the launch of the final product. Priess-Heje et al mention how in the artificial setting there are predetermined prerequisites, as for instance planed problems or situations. As Koskinen et al also mention, these prerequisites makes it easier to focus the evaluation on specific parts of the design. However the downside is that it can remove focus from more general problems which might be overlooked. In a field test, or what Pries-Heje et al calls a naturalistic evaluation, the design is tested in its real environment on real users who

have not been instructed in the use of the design or the goal of the test. The main advantage is, that the open boundaries make it easier to discover more general problems with the design, that the designers might not be able to foresee. (Pries-Heje et al, 2008: 6)

The table below is made to sum up the discussed points. Based on this, the lab based focus group interview seems most appropriate in this phase of the design process, since what is needed is feedback on specific selected themes, to spawn ideas for changes and adjustments.

Lab vs Field	Lab	Field
<b>Logistics</b>	Easier logistically	Harder logistically
<b>Understanding</b>	They will likely understand that it is a prototype - maybe making them more open and willing to imagine the final design	Might expect something something that works and prevent respondents to imagine the final product
<b>Control</b>	More control and awareness over the situation and its variables Possibility of purposely changing variables (including showing different design options)	Can have many changing and uncontrollable variables Hard to purposely change variables
<b>Hypotheses</b>	Capable of testing conflicting hypotheses	Hard to test conflicting hypotheses
<b>Focus</b>	Specific aspects - might overlook general "hidden" problems	More general - better for discovering "hidden" problems
<b>Collecting results</b>	Good for having dialogue about specific aspects (by presenting aspects directly)	Good for an afterwards dialogue and for observing

*Table showing the discussed differences between the field and lab approach to testing*

## What should (not) be Tested?

Perhaps it is easier to start out with the question, what should not be tested? One of the main purposes of the design is to support the gathering ritual and thereby the transformation of people to become members of the audience. This, however, is extremely difficult to test as a whole. First of all, most people will probably not understand whether or not they have been properly transformed and the fact that they might not have anything to compare it to, makes it even harder to test. Second of all people arrive at the theater in many different moods, with

different past experiences of theater, with different expectations, in different company. All these external factors contribute to the difficulty of testing if the transformation generally works.

In this thesis I will avoid testing if gathering rituals in general as a phenomenon works. Instead, the effects and importance of gathering rituals in general will be seen as the truth based on the knowledge from the Analysis chapter. The test will instead pose questions about if the design works for supporting specific parts of the gathering ritual, and not test the transformations themselves.

An important part of the gathering ritual is its ability to support social interaction. It enables the soon to be audience to talk about expectations to the performance, and e.g. what happened before they arrived to the theater and get that out before something completely different is going to happen. That the design works for social interaction is crucial for the gathering ritual and therefore the test will have a focus on that.

Another thing to test, without testing the gathering ritual in itself, is how the elements meant to support the gathering ritual are experienced. This includes thoughts on the light sequences. The test is conducted to get feedback and to spawn ideas for improvements, also on the overall concept and the execution of it. As I will get more into later in this chapter, the results of the test are very valid as inspiration and to get new perspectives on the design. However it is important to note that it is based on a very small nonrepresentative population and therefore should be taken with a grain of salt.

**The main hypotheses that will be investigated in the test are:**

- The respondents sees the tables as welcoming and inviting, and want to use them
- The respondents understand the tables' link to campfires/barrels
- The respondents thinks the design works for social interaction
- The respondents understand understand that the wall sequence is related to the time of the show start
- The respondents think that the play of brilliants on the walls should increase in intensity towards show start

- The respondents think that the design creates an interesting but comfortable environment

## The Test Setup

The plan for the test was to present the interviewees with 3d renderings of the design as well as a physical 1:1 model, so they would be able to try it themselves.

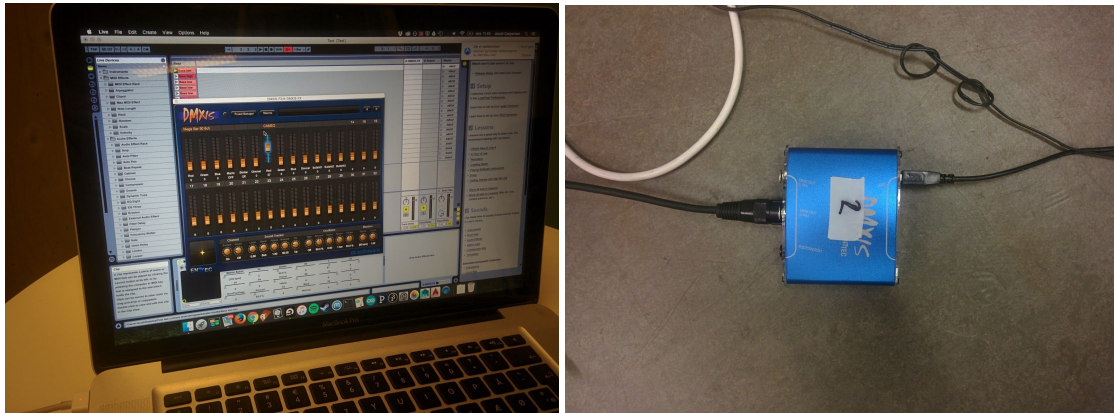
For conducting the test I needed to make a mockup of the table. This was done in a so-called “quick and dirty” way, by finding a box in the right height, putting a piece of diffusing material on top (plexiglass), and placing DMX-controllable light fixture inside (Cameo Studio PAR 64 CAN RGBWA+UV).



*Pictures of the Cameo Studio PAR 64 CAN RGBWA+UV inside the table mockup*

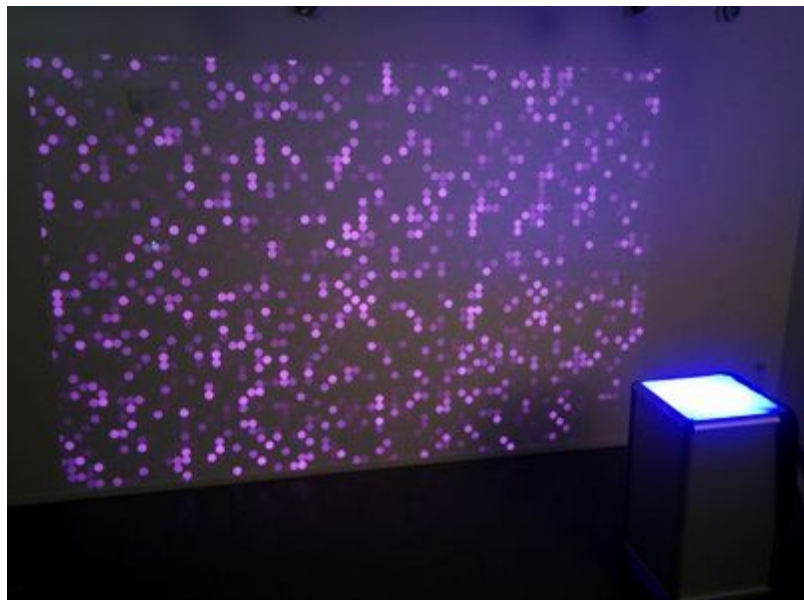
For controlling the fixture I used the computer program I made (described in the Design chapter). This computer program would send midi-signals to the light sequencer that would then send RGB-values accordingly in the DMX protocol through the ENTTEC DMXIS DMX-interface to the light fixture.





*The DMXIS light sequencer (left) and the ENTTEC DMXIS DMX-interface (right)*

At the same time the computer program would keep track of the colours for the tables in combination with the wall, while creating the video output for the walls. For simulating the walls I used a projector placed across the room.



*The test setup with wall and table mockup*

The external lighting in the room was adjusted to illuminate the wall across from the projection in an attempt to mimic the lighting conditions from the design in its current stage shown in the design chapter.

All in all this combined to a working prototype of the system, where both table, walls and their connection could be tested, with custom made software very similar to the programs that should be used for a final implementation. Technically the only difference was that instead of using a sensor to trigger the tables, the program was written to react to a click of a mouse. This enabled me to activate it discretely when the respondents would occupy the table. The reason why I did not have the system reacting to a sensor was, that at this stage, it would not be relevant to test. Similar uses of sensors are all around us and very well tested, thus the only thing to be tested could be things like placement of the sensor. However at this point with a relatively unfinished design, it would be quite irrelevant.

## Conducting the Test

The test was held in a very similar way to a focus group interview. 3 people were invited. They are all 25 or 26 years old and live in Copenhagen. A narrow group demographically. However they had all watched at least one theater performance in a modern theater within the last year. As mentioned earlier the most important thing was to get some other perspectives, and get a dialogue working. The respondents knew each other very well beforehand, which is an advantage, in the sense, that it makes it easier for them to express their thoughts even if they contradict the others’.

The interview was to a high extent based on Richard A. Krueger’s guide *Designing and Conducting Focus Group Interviews* (2002). Here he explains that the introduction to the interview should present the topic and set the ground rules for it. For this explained this to the respondents:

*“There are no wrong answers but rather differing points of view. Please feel free to share your point of view even if it differs from what others have said. Keep in mind that I am just as interested in negative comments as positive comments, and at times the negative comments are the most helpful.”* (Based on Krueger 2002: 4)

After this I showed a video on the projector of the space with tables and the wall animated. At this time the physical table mockup was turned off to not distract the respondents too much.

The context of the space was explained and the respondents were told to imagine being in a theater foyer. After that they were asked about the mood and atmosphere of the space to get them talking. Every question was constructed to lead towards a specific theme, that I wanted to discuss, without expecting concrete answers. Many times during the test I used probes to get elaborations on the opinions and statements of the respondents.

*“The crux of any laboratory study is experimentation. The researcher manipulates the thing of interest in the lab to learn how people react to it while holding other things constant.”*  
(Koskinen et al, 2011: 57)

After asking different questions about the space the mockup was revealed and the system was started, now using the projected image as *the wall*. The respondents were told that this was a very simple mockup of what they had just been shown. They were told to imagine being in that place, and to walk over to the table. The length of the sequences was adjusted. So instead of the wall taking an hour to go through its sequence, it would take 100 seconds. The sequence of the table (dependant on the wall) was of course adjusted just by changing the pace of the wall. After a while, the table was activated and started changing colours. Here questions were more specifically asked about the system.

The test was concluded with the questions “What do you think is the most important thing we have discussed?” and “Are there anything you would like to add about it? Have I missed anything?”. This was to give the respondents a final chance to express their opinions again based on Krueger’s recommendations. (Krueger 2002: 7)

The test was a success and in the next chapter the results will be discussed and used to further improve the design. The whole interview is included as an audiofile in the appendix as well as notes and quotes from the interview. (Appendix 1 and 3)

# Redesign

The test gave a lot of valuable insight and created the basis for a reflection on the design and spawned ideas for things that could be improved. In this chapter I am going to reevaluate some of the design choices and come up with new elements to improve the design.

## Discussion of Adjustments

When initially discussing the first impressions of the design and space, all of the respondents seemed to immediately react to the tables in a positive way. They seemed to really like the colour. Without explaining the inspiration from bonfires it seemed that at least two of the respondents understood the connection right away.

*“I like the colour inside the tables. It is very cozy. It is a little bit like a fireplace. It indicates cozyness and conversation. Its not like: “Here you are going to fall asleep”* (Sara, appendix 1, question 3)

When asked if the tables felt inviting for social interaction the respondents responded very positively as well, using words as “warm” and “looks like somewhere you could have a drink or some sort of cocktail” (Sebastian, appendix 1, question 4). So it seemed that they generally liked the tables and thought that they could fulfill the role of inviting people to come closer and interact. As with every result from the test this should be taken with a grain of salt, because of the small amount of respondents, but it gives a clue, that the tables might not be the most important part to work on for the next iteration. They mentioned the importance of the quality of the materials of the tables, because of the possibility that they might end up looking cheap (appendix 1, question 13). I share that view, and in my opinion, objects can quickly end up looking cheesy when light is placed inside them. This can be helped by choosing the right materials.

Both Sara and Louise expressed opinions about the pendants over the tables. Sara thought they did not look like they did much, and might ruin the style a bit, while Louise thought that they should change colour as the tables and that they otherwise might not fit properly together. (appendix 1, question 3)

In the rendering shown, the pendants are actually only have a luminous flux of 50 lm, but help minimize the shadows created on the faces from the tables. To investigate whether they are necessary a comparison was made.



*(Left) With pendant with warm white light. (Middle) No pendants. (Right) Pendants changing colour with the tables*

The left picture is the design from the first iteration, where the face is lit with a warm white. The idea behind this was to make people look more pleasant and the face more readable. In the middle picture the pendant are gone. The face appears much darker and the shadows from the contours of the face makes it harder to read. As humans we rarely see another person's face lit from below, and this might add to the difficulty of reading it. On the positive side, lighting the person only with the colour of the table might make the effect of the rite of passage stronger, since there is no other light to make him stand out. Lighting him with another colour from the pendant takes the person a little bit away from the ritual. On the right picture, the pendant changes colour with the table. Here there are no hard shadows and it reaps the benefits of only being lit by one colour. The downside is, that people might not look

as pleasant as with the warm white light from the pendant. But this might be worth sacrificing to improve the feeling of immersion in the ritual. Therefore this will change in the next iteration.

About the tables themselves, it was pointed out by one of the respondents, that it was important the light in the tables would not be too powerful (Louise, appendix 1, question 10). This was mainly a comment to if it would make the space confusing, but the amount of light is relevant to discuss in different aspects. In a lecture with professor Marc Fontoynt, he said that humans are more sensitive to light coming from below than from above. This is supposedly due to the fact that light in nature (and everywhere else) usually does not come from below, and thus we should be more sensitive. This might make the perceived brightness in the tables higher. In this design, the luminaire in the table is 2000 lm (more details on light sources and materials in the Final Iteration chapter). There is a commonly used rule of thumb of ratios for illuminance levels especially in work situations. (Bülow-Hübe 2008: 14) The contrast should maximum be 1:3 between visual task and adjacent area and 1:10 between visual task and non-adjacent surfaces (new-learn.info 2016). Thus the amount of light in the table should be adjusted to the amount of light in the rest of the room, so that the radiant exitance of the table is maximum 10 times as high as the illuminance on the surrounding floor.

At different times during the test, it seemed that the respondents thought of the wall as something you would look directly at the whole time or remind themselves that oftentimes people would have their backs turned to it. (appendix 1, question 3 & 5) This might have been a side effect of conducting a laboratory test. The wall is meant to provide an ambience and mostly subconsciously affect people's experience. But when it is put into an artificial environment and when questions are asked directly about the design it takes a different role. It is quite difficult to test something that is meant to be relatively subtle. Therefore some of the responses about the wall should be taken with a grain of salt.

When asked if they thought that the activity on the wall should increase or decrease towards the start of the performance, one of the respondents came with the following statement:

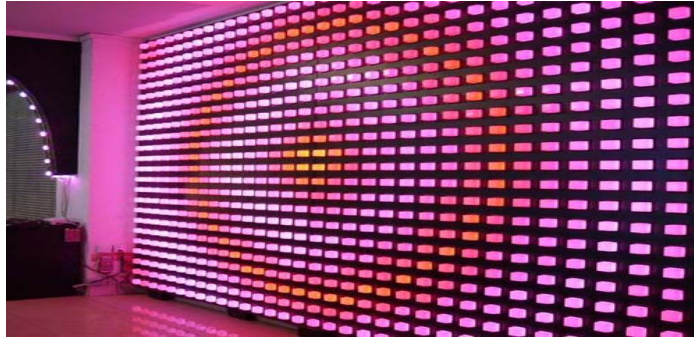


*"Maybe it would create some peace around the experience to have it settling down towards the beginning. There might already be a lot of people. But I don't know what I would prefer. Maybe older people would think that the dots are confusing, because there are so many and they go faster and faster, so maybe that would be a little stressing. But for us young people it is good."* (Sebastian, appendix 1, question 6)

Again the feedback here is tricky, since it focused directly on something that is meant to be subconscious. Decreasing the amount of activity more and more the closer to the start of the performance might relax the soon-to-be audience. The goal is to prepare them, and being relaxed and not overstimulated could be very beneficial. It is a balance because on the other hand I think, that building up the excitement before the show makes people prepared in another sense. However when put the way Richard Kelly describes play of brilliants, it seems convincing to keep it intensifying:

*"Play of brilliants excites the optic nerve, in turn stimulates the body and spirit and charms the senses. It creates a feeling of aliveness, alerts the mind and awakens curiosity, and sharpens the wit. Play of brilliants quickens the appetite and heightens all sensation. It can be distracting or entertaining."* (Livingston 2014: 12-13)

During the test the wall was often referred to as a screen. One of the respondents thought that it might be a bit boring with the dots, but when asked if it had anything to do with it being a screen, they all seemed to agree (appendix 1, question 14). Actually the wall is not a screen (like a television or computer monitor), but an LED matrix. This might however not be visible on the 3d renderings, and that might give some confusion, even though it was explained that it was not really a screen.



Example of LED wall matrix (Picture 5)

The respondents seemed to expect other things from it because they thought it looked like a screen. Screens are often something that we focus directly on and expect to provide us with information. While the wall in this design actually provides information e.g. about how close one is to the start of the performance, it should not look too much like a screen.

*“With screens we are used to that they are telling us something. And sometimes you can press them and stuff. So screens are often information”* (Sebastian, appendix 1, question 6)

This inspired me to change the design in another direction to make it look less like a screen, while still keeping a grid-like structure. Screens are usually two dimensional. Changing the design of the wall to become more three dimensional would make it look less like a screen and more like something else.



*The wall, now with glass pyramids*



So the design of the wall changed to have slightly diffused 40x40 cm glass pyramids acting as pixels. As it can be seen on the above picture, the sides of the pyramids reflect the ones next to them, as well as communicating with the rest of the space by reflecting it. Inside each pyramid is a 10x10 cm square LED matrix. The pyramid structures were chosen for their simplicity and for their ability to easily fit into a grid.

An interesting thing could be to mark the transition between foyer and the theater house where the performance will take place. To underline that the rite of passage and gathering ritual is over, and that now they enter a new space with their newly acquired role. This could be done simply by highlighting the doorway. This will also have a practical purpose so that people know where they are gonna go when it is time, but might also give a perspective on their experience in the foyer knowing that what happens behind that door is what they are here to see, and what they are waiting for.



*(Left) Iguzzini Trick mounted on garage doors. (Right) Iguzzini Trick luminaire (Picture 6 &*

*7)*

This could be done using LED strips on the site of the doorway, but an interesting way of doing it could be using the Iguzzini Trick like on the picture above to the left. This extremely narrow beam luminaire is first of all easier to maintain than LED strips since there is only 1 luminaire. Secondly when the people walk through it, it gives a *scanning*-like effect enhancing the experience of stepping into something different.

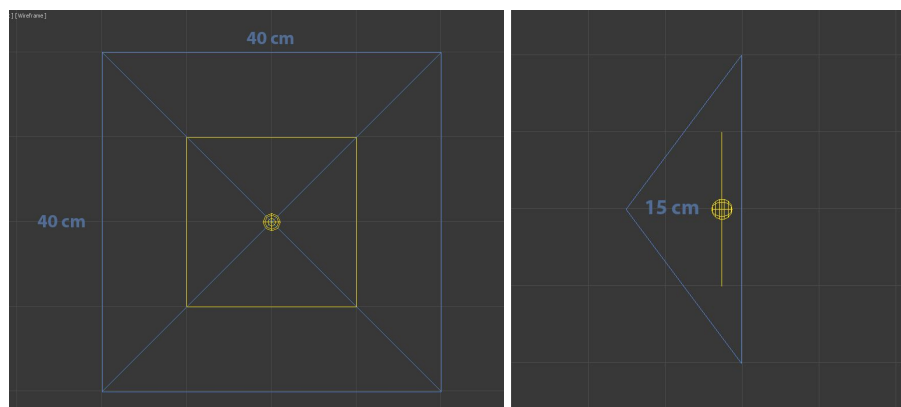
## Final Iteration

In the following I will sum up the final iteration of the design and all of its elements.

### The wall

The wall have a specific light sequence that starts an hour before the beginning of the performance.

The wall is made up of an array of diffused glass pyramids. The glass should have a 50% transparency index and 50% reflection index. The base of the pyramids are 40 x 40 cm and they are 15 cm heigh. Inside each pyramid is a 10 x 10 cm LED array. Their maximum output is 100 lumen.



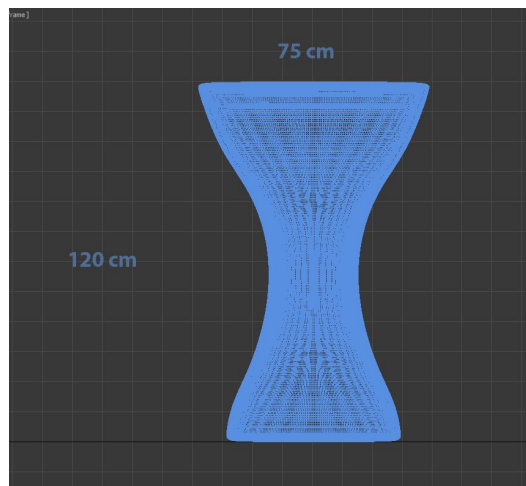
The wall have a build-in light sequence:

- The light sequence of the wall go through a spectrum of hues during this hour going between hue values of 0-100.
- Each pyramid lights up in a certain hue and fades out.
- The speed of new pyramids turning on increases along a sine wave towards the beginning of the performance, so that the wall appears more and more active.



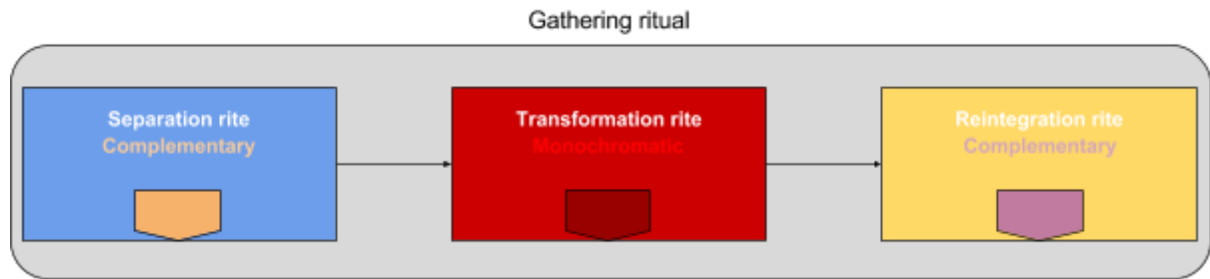
### The tables

The bottom of the tables are made of concrete, and the tabletop is made of diffused glass. The glass have a slight yellow tint on the inside layer, to give it a flame like effect when it is not occupied. It should have a translucency index of 70 % and diffusion level of 70%. Inside the tables is an individually controlled luminaire directed towards the top of the table. These have an luminous flux of approximately 2000 lm.



Each table have a light sequence that fades on 15 seconds after a person occupies the table.

- When not active, the tables have a warm flame-like colour to mimic a fire.



- The colour of the tables is related to the colour of the wall and the time they were activated. They go through a sequence similar to the diagram above based on when they are activated. This is done to support the rite of passage.



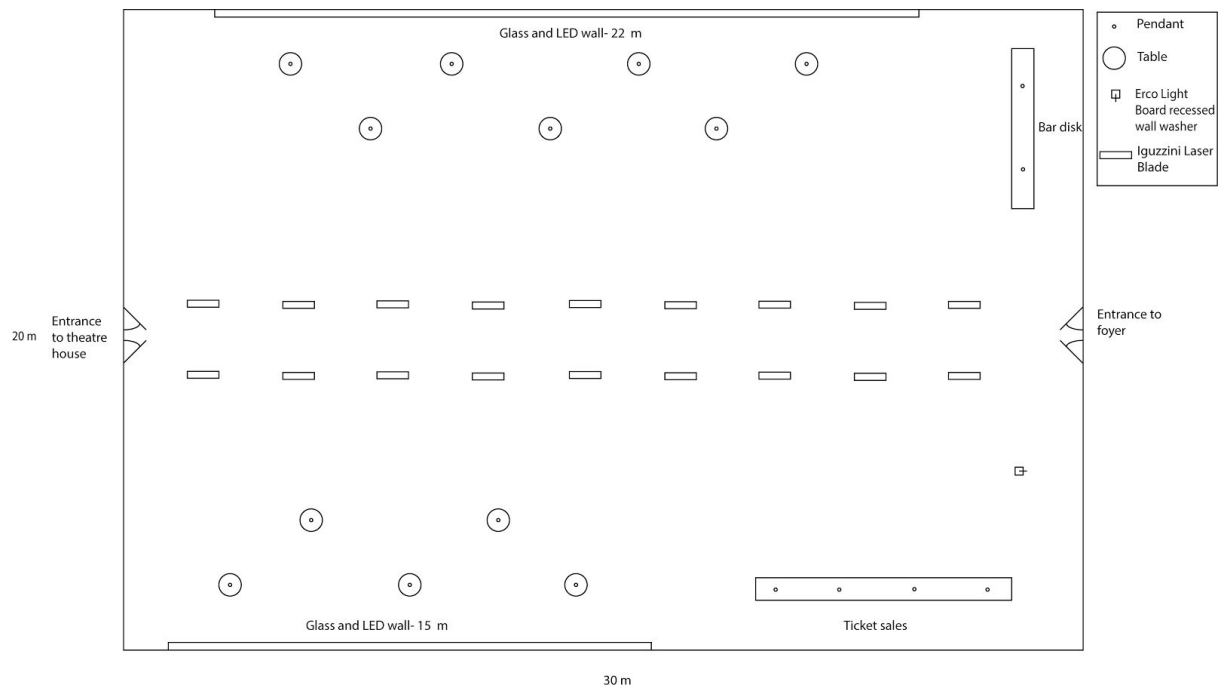
### The pendants

There is a pendant over each table providing vertical illumination this is to support the social interaction by making people's faces more pleasant looking and their facial expressions more readable by eliminating hard shadows. The pendants share their colour with the table they hang above. This allows the whole person standing next to the table to be illuminated by this colour.

### The space

The space includes a disk to buy tickets and a bar disk. On each side of the room is a light wall and tables. The space have been scaled up a bit to make the size a little more

realistic. It is now 20 x 30 x 3,2 m. The floor in the middle of the space is illuminated by 18 Iguzzini Laser Blade MQ25 1700 lm 3000 k 32 degrees flood version.



*Floorplan of the design*







*Visualisation of the design*

## Summery




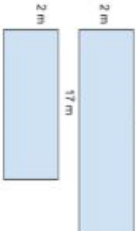
To conclude lighting sequence on the walls are inspired by the shimmering effect of the sun in water. The wall is made of a grid of glass pyramids with small LED arrays inside them. They will provide an increasing amount of excitement by increasing the amount of brilliants the closer it gets to show start. They also have a specific main colour with adjacent colours that goes through a spectrum towards the start of the performance. At the same time the tables inspired by fireplaces invite people to interact. They also have a sequence of their own activated when people occupy the table. Related to the wall the sequences for the individual tables create a ritual for the audience transforming them to members of the audience.






# Technical Suggestions for Implementation

Table					
Element	Requirement	Suggestion	Picture	Price est.	
Tabletop material	Hiding the light source and diffusing the light. Help with the appearance of a flame. Not look cheesy	Diffused glass have a slight yellow tint on the inside layer. It should have a translucency index of 70 % and diffusion level of 70%		2.000 kr	
Bottom material	Look heat resistant and heavy	Custom made concrete casting with many dark stones		5.000 kr	
Luminaire	DMX controlled LED luminaire - high heat tolerance Minimum 2000 lm in all channels	Cameo Studio PAR 64 CAN RGBWA+UV		2.200 kr	
Overall object	Be in a height where you can use it standing up. Have a width suitable for a bar table. Hole in bottom material for 3 sensors	The table should be 120 cm high and the tabletop should have a radius of 75 cm		Total pr table 9.200 kr	


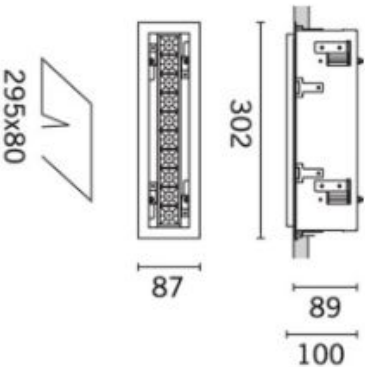

## Wall

Element	Requirement	Suggestion	Picture	Price
Pyramid material	The material should be diffused enough to hide the light sources. It should be able to reflect the light from space and surrounding pyramids	Diffused glass. It should have a 50% transparency index and 50% reflection index		100 kr pr pyramid
Pyramid dimensions	Large enough to contain light source	40x40x15 cm		
Light source	Individually controllable LED matrix Provide at least 100 lumen pr matrix	2015 New keystudio I2C 8x8 LED Matrix HT16K33 Lattice Module		1 pr pyramid x 25 kr
Overall object	Walls large enough so that you can see them when you stand by a table	A 22x2 m wall will need 550 pyramids and light sources A 17x2 m wall will need 425 pyramids and light sources		Total for 2 walls 100.000 kr



System					
Element	Requirement	Suggestion	Picture	Price	
Sensor for tables	Have to not be affected by changing visible light	PIR sensor - an infrared sensor 3 pr table	 A green printed circuit board (PCB) with a white hemispherical lens in the center. Four gold-colored pins are visible on the left side, labeled from top to bottom: "VCC", "Output", "Ground (GND)", and "DC voltage".	3 pr table x 15 kr	
A computer	At least two USB ports and running windows or Mac OS	Packard Bell iMedia S2984	 A black, vertical, tower-style computer case with a single horizontal slot near the top.	1 x 2.300 kr	
DMX interface	Communicate via MIDI or a Processing library	ENTTEC DMXIS	 A blue and black rectangular device with a clear plastic top. It features two XLR connectors on the front and a 1/4" jack. The text "DMXIS by ENTTEC" is printed on the front.	1 x 1.000 kr	

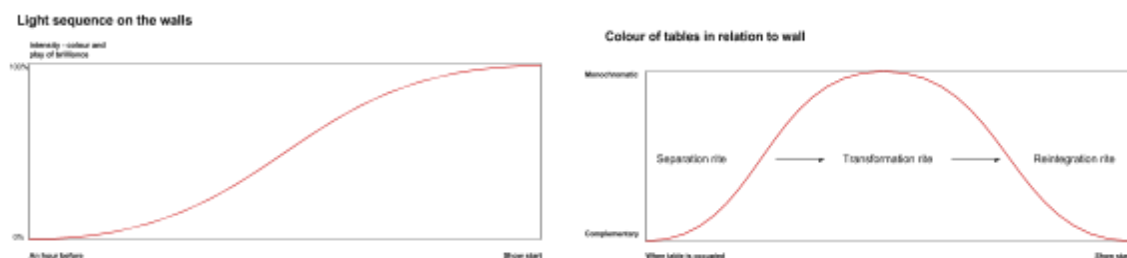
# Rest of space

Element	Requirement	Suggestion	Picture	Price
Pendants	A pendant giving a lot of light vertically	Very simple tube shaped pendants in a slightly diffused glass. They only need to have a luminous flux of 70 lm because of the tables. They have to be able to change colour		200 kr
Ceiling Luminaires	Luminaires providing light on the floor without glare for people using the space	18 Iguzzini Laser Blade MQ25 1700 lm 3000 K 32 degrees flood version		54.000 kr
Door luminaire	Lighting up the <u>edged</u> of the doorway to the theatre house	Iguzzini Trick 360		2.000 kr

# Conclusion

This thesis have revolved around the research question *How can lighting be used to support the gathering ritual in aesthetic performances described by Richard Schechner?*. This question have been investigated through practice by creating a lighting design for an imaginary theater foyer in a contemporary theater. The final design as a whole can be seen as an example of the use of the research based foundation. Rather than the design, this foundation should be seen as the actual product of the thesis along with the technological system controlling it. The technological system is designed to control the connection between focal points and the ambient luminescence and can be used in many applications other than this concrete design. This, along with the principles behind it, can also be used for a number of other gathering rituals for aesthetic performances such as before concerts or in movie theatres.

However the concrete lighting design for the foyer in a contemporary theatre consists of two main components for the focal glow and ambient luminescens; tables with light in them and a lighting wall. The wall has a light sequence build into it where it goes through a spectrum of colours and takes advantage of the effects of play of brilliants increases in activity towards the start of the performance. This is done to excite the soon-to-be audience and prepare their senses. The sequence progresses along a sinus curve.



The colour of the tables mimic a campfire when they are not occupied. Around 15 seconds after a table detects that it is in use, it will fade on to its light sequence. This is a sequence of colours related to the current colour of the wall. It goes from being complementary to being monochromatic with the wall and back to complimentary. The tables illuminate the people

with their coloured light, first separating them from their surroundings, then integrating them, and then separating them again. This sequence is following the structure of a rite of passage symbolizing the people's transformation into an audience, while inviting people to interact with each other supporting the social aspect of the ritual. Thus the lighting design supports the gathering ritual described by Richard Schechner.

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## Pictures

Picture 1

<http://il5.picdn.net/shutterstock/videos/7524022/thumb/1.jpg>

Picture 2

<http://cache.gawker.com/assets/images/gizmodo/2009/10/stadium.jpg>

Picture 3

<http://littlemoments.dk/wp-content/uploads/2014/11/Varmt-kul-1024x682.jpg>

Picture 4

<https://dk.pinterest.com/explore/burn-barrel-918468601490/>

Picture 5

<http://www.novavisionny.com/LED-Matrix-Dot.jpg>

Picture 6

<https://s-media-cache-ak0.pinimg.com/736x/b6/fb/12/b6fb1273cf2e971eb375e19a8096723f.jpg>

Picture 7

[http://www.lighting-inspiration.com/wp-content/uploads/2015/03/Lighting-Inspiration.com\\_I-Guzinni\\_Trick-360.jpg](http://www.lighting-inspiration.com/wp-content/uploads/2015/03/Lighting-Inspiration.com_I-Guzinni_Trick-360.jpg)

# Appendices

## Appendix 1

26/5/16 - 16.30

Lo: Louise Boldt, age 26, Copenhagen, Working as secretary

Sa: Sara Nørregård, age 25, Copenhagen, Master's degree in Communication

Se: Sebastian Bjerril, age 26, Copenhagen, Student - Journalism

1. "There are no wrong answers but rather differing points of view. Please feel free to share your point of view even if it differs from what others have said. Keep in mind that I am just as interested in negative comments as positive comments, and at times the negative comments are the most helpful."

2. Show video - tell them that this is a foyer to a very modern type of theatre. Explain that there is a light inside the tables and that it is an LED wall that has a sequence and changes over time.

3. Ask about the atmosphere and the mood of the space. "Is there something you like/dislike?"

Sa: I like the colour inside the tables. It is very cozy. It is a little bit like a fireplace. It indicates cozyness and conversation. Its not like: "Here you are going to fall asleep"

Sa: But the lamps above - in the video it doesn't look like they do so much. Maybe it destroys a bit of the stylishness in some weird way. I am not sure I can explain it.

Lo: I think that if the tables are changing colours but the lamps don't then they don't really fit together. Maybe it is the same when the colour changes in the tables and sometimes don't match the wall.

Lo: I like that part (green wall, fire coloured tables). It has a bit of a forest feeling to it and that goes nicely with the bonfire.

Operator: Does the wall take up too much attention?

I think if you are standing by the tables you probably won't notice it as much as here when we are looking directly at it. Then the focus is on something else and the change in movement and colour might not take so much attention.

Sa: You are standing around the tables and you might even have your back turned to it. You will probably notice it.

Se: Yes I think you can kind of sense it

Sa: Yes that might make it quite cool with the colour changes, that it is not something you have an eye on all the time. I really like the colours.

4. "What about the tables? Is there something you like or dislike about them? Would you want to use them?"

"Do you feel like they are inviting? Can you explain why"

Lo: I think the tables give kind of a southern mood. It reminds me of being outside when the sun is setting.

Sa: I think they are very inviting

Se: It looks like somewhere you could have a drink or some sort of cocktail.

Se: It looks like it is warm.

5. "The dots on the wall comes faster and faster towards the beginning of the theatre play. Do you have any thoughts about that?"

Sa: I think that the movement in the dots is very continuous. There is not much difference between what is happening at different parts of the wall and that makes sense because you are probably not going to look at it in its entirety.

Sa: Right now I am maybe getting a little dizzy looking at it. But I really like the idea that it gets more and more intense towards the beginning of the performance

6. "Do you like it that way, or do you think it should be less and less intense/fast?"

Se: Maybe it would create some peace around the experience to have it settling down towards the beginning. There might already be a lot of people. But I don't know what I would prefer. Maybe older people would think that the dots are confusing, because there are so many and they go faster and faster, so maybe that would be a little stressing. But for us young people it is good.

Lo: Do people know when they get in that it is intensifying towards the beginning? If you actually knew it, then maybe the perspective would change (Around 8.30)

Operator probe: Do you think that people are able to decode that it is intensifying and culminating when the performance begins?

Lo: I think I would just see it as part of the decorations.

Sa: You would probably be able to decode it if there were something in the bottom going further and further towards something, like a loading bar. As it is there I don't think I would realize it. It doesn't invite to standing and looking at it the whole time and that way it is kind of secondary.

Se: Maybe if the motive matched the play that people were going to see, then maybe they would realize that there is a connection.

Sa: But often in a modern theatre you don't really know what to expect.

Se: Yes but it could be cool if it created the mood that you wanted the audience to enter with.

7. Let them walk over to the table. Tell them that when you walk over to a table, after a few seconds it is activated.



8. "The tables have a sequence that is related to the wall going from complimentary to the same color and back to complimentary"

9. "Is there anything you like or dislike about this?" "The combination"

Sa: I am not sure if I would notice that the colours would be opposite or the same at different times.

Se: Did you say that it went from opposite and then the same and back again? Because I really like that because it implies that okay now we are going on to something else.

Operator probe: What do you other guys think of that. Does that make sense?

Sa: Yes, but maybe when the table starts changing colour I am not sure that the focus would be on both the tables and the walls. I think I would just be fascinated by the table changing colour. Also because it is a table where something is standing on.

Se: I think there would still be someone who would realize that it had a connection.

10. "Imagine that many of the tables are activated at different times showing different colors. What do you think about that"

Lo: I would think that would be really cool. And also the technique behind must be really advanced. I am not sure my brain would understand how.

Operator: Do you think it would be confusing to be in such a place or would it be exciting?

Lo: It depends very much on how much the tables are lighting. It should not be a disco show. So how much light the emit into the space. Because this (the light from the mockup) would not disturb anyone else in the space. But if it was quite powerful, then it might get a bit confusing.

11. "The idea behind is to have individual sequences. Do you like that or do you think that all the tables should go through the sequences related to the wall at the same time?"

Se: Well the first option gives more colour difference. It gives an alive room. But if it was the same colour then it creates some kind of mutual feeling. So when someone is activating a table then they are suddenly part of something. So I think each is good in its own way.

12. Showing pictures of man by orange table and purple table - "Do you have any idea for elements that could be changed to improve the design?"

Lo: How big is the space? In this picture it looks like there is quite a lot of space.

Sa: A good thing could be if there is enough room, so that you don't have to stand in the middle of it and have the option to go over to the tables. Because in a foyer it is not only conversation. There is also a lot of other things going on. Maybe one is standing and waiting and so on.

Se: Theatre is often connected to something very traditional. And this is very modern. It has to match the theatre plays that are there. Because I definitely go in with another feeling here

than I would in a traditional theatre. So it gives clues that this is another kind of performance I am going to see. The connection between the modern and futuristic has to be there.

Sa: I think it makes good sense in a place like Nørrebro teater. I can definitely see that working there. I saw the play "alle elsker kærlighed". In that play there was a lot of interaction and that would fit perfectly. The Royal Theatre has connotations to something completely different.

13. Showing pictures of the table on its own in a current and earlier version - "What about the tables. Do you have anything you like or would change here?"

Sa: It has to be heavy enough to not tilt.

Se: It looks pretty heavy

Lo: Is it glass? That is good because if it was this kind of glass (pointing at plexiglass) it might look a bit cheap.

Se: Yes it is important that it has good materials.

Sa: I like that it is broader on top than on the bottom because it draws the eye to the top.

Operator probe: Do you think it should be slimmer or thicker? (showing a picture of the table in iteration 1)

Sa: I like the other one much better.

14. "What do you think is the most important thing we have discussed?"

Sa: The only thing I think might get a bit boring is the dots.

Operator probe: Do you think that you expect more excitement because it is a screen? And that you expect something else because of it.

Sa: Yes, but also because it takes up so much space on the wall

Se: With screens we are used to that they are telling us something. And sometimes you can press them and stuff. So screens are often information

Sa: A fun balance is also that if you are drawn by the screen then you might also be bored with it faster. But here it makes good sense when it is a room where you converse. And you are actually going in to watch something.

Operator probe: Would it make it better or worse, if there were smaller walls more related to each table?

Sa: I think it would make it worse.

15. "Are there anything you would like to add about it? Have I missed anything?"

Lo: What kind of material is the table made of?

Operator probe: Here it is concrete with lots of dark stones mixed in, to make it darker.

## Appendix 2

```
import promidi.*; // Importing the external Promidi library
MidiIO midiIO; // Creating an midiIO object of the midiIO class from the promidi library
MidiOut midiOut; // Creating an midiOut object of the midiOut class from the promidi
library

float timeElapsed=0; //Counts seconds from the beginning of the program
float totalTime=100; //Here the total amount of seconds before showstart is set
float timeLeft; //This remembers how much time was left when the table was activated
float timeFromStart=0; // This keeps track of how much time has passed since the activation
of the table
float brilliance; //This value is used for the amount of brilliance on the wall
int wallHue;
int oldSecond; // This is used as part of keeping track of how many seconds have passed
color tableColor; // This is a colour variable used for determining the colour of the table

boolean start=false; // This variable stores wether the table is active or not
boolean once=true; // This is used for functions only running once

float monochrome; //This is used to store the relationship of the colours of table and wall
and how close they are to each other in %

void setup() {

  colorMode(HSB, 100); //Setting the colourmode to Hue, Satuation, Brightness: 0-100
  size(1500, 1000); //Size of the wall/screen
  background(0); //Black background
  noStroke();
  smooth();

  //Creating instances of midiIO and midiOut from Promidi-library
  midiIO = MidiIO.getInstance(this);
  midiOut = midiIO.getMidiOut(0, 1); //1 for mac 3 for pc
}

// mouseClicked is used in stead of a sensor to activate a table
void mouseClicked() {
  if (start==false) {
    start=true;
  } else {
    start=false;
  }
}
```

```

void draw() {

    //These statements are calculating how much time has past since beginning and since
activation of table
    if (oldSecond!=second())
    {
        timeElapsed++;
        if (start==true) {
            timeFromStart++;
        }
    }

    //Here the wallHue value is calculated. It is sinus to "time passed since the program
started"/"Overall amount of time"*90
    //wallHue stores a value from 0-100
    wallHue=int(sin(radians(timeElapsed/totalTime*90))*100); //int() is used to convert from
float. Radians function is used to convert from degrees to radians

    //These for-loops generates the dots on the wall
    for (int i = 0; i<1500/20; i=i+1 ) {
        for (int j = 0; j<1000/20; j=j+1) {
            //Here the brilliance value is calculated. It is sinus to "time since the program
started"/"Overall amount of time"*90
            //Brilliance stores a value from 0-1
            brilliance=sin(radians(timeElapsed/totalTime*90)); //radians function is used to
convert from degrees to radians

            // This generates random numbers between 0 and 1000*brilliance. It goes from
generating up to 1000 different numbers to only 1 number
            float k = random(1000-(1000*brilliance));

            //In this statement, whenever k is less than 1, a dot appears on the wall. This gets
more and more frequent due to the above random generator
            if (k<1) {
                fill(wallHue, 50, 100);
                ellipse(i*20, j*20, 20, 20);
            }
        }
    }

    //This gives a transparent tint to the colour of the wall to enhance it
    fill(wallHue, 50, 15, 2);
    rect(0, 0, 1500, 1000);

    //This is another way to make a random generator that does the same as the "k" one above.

```

```

It adds a black layer more and more frequent in order to hide old dots
//Faster and faster to make the screen seem more alive
if (random(1000)<1000*brilliance) {
    fill(0, 0, 0, 2);
    rect(0, 0, 1500, 1000);
}

if (start==false) { //If table is not activated

    //These are sending midi controller signals to fader 1,2 and 3 that control red, green
and blue on the fixture
    //The colour is a warm almost amber white
    //I am dividing by 2 since the faders go from 0-127 and not 0-255
    midiOut.sendController(new Controller(1, int(252/2)));
    midiOut.sendController(new Controller(2, int(197/2)));
    midiOut.sendController(new Controller(3, int(143/2)));
}
if (start==true) { //If table is activated

    //This statement calculates how much time is left when the table is activated and saves
it in the timeLeft variable
    if (once==true) {
        timeLeft=totalTime-timeElapsed;
        once=false;
    }

    //Keeps track of the relationship between how much time has passed since activation of
table and how much was left when it was activated
    //It store a fraction between 0.5-1.5
    monochrome=(timeFromStart/timeLeft)+0.5; //The +0.5 is to make them monochromatic in
the middle of the sequence and not in the end

    //table is here in HSB100 colour space
    //The color is progressing along a sine wave because it is dependant on the wall hue
    tableColor=color((wallHue+monochrome*100)%100, 50, 100); //Time elapsed is used as the
Hue of the wall. It gets monochromatic then the monochrome variable is 1

    //These are sending midi controller signals to fader 1,2 and 3 that control red, green
and blue on the fixture
    //The colour is a warm almost amber white
    //I am dividing by 2 since the faders go from 0-127 and not 0-255
    midiOut.sendController(new Controller(1, int(red(tableColor)*2.55/2)-1));
    midiOut.sendController(new Controller(2, int(green(tableColor)*2.55/2)-1));
    midiOut.sendController(new Controller(3, int(blue(tableColor)*2.55/2)-1));
}

```

```
println("Time ellapsed in total: "+timeElapsed);
println("WallHue: "+wallHue);
println("Brilliance (1 is 100%): "+brilliance);
println("Time from Start (table): "+timeFromStart);
println("Time left (at table start): "+timeLeft);
println("Monochrome (1=100% monochromatic): "+monochrome);
println("Red: "+red(tableColor)*2.55);
println("Green: "+green(tableColor)*2.55);
println("Blue: "+blue(tableColor)*2.55);
oldSecond=second();
}
```

## Appendix 3

Audio recording from focus group

## Appendix 4

Video



**AALBORG UNIVERSITET**